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**THE EFFECTIVENESS OF PARTICULARLY SENSITIVE SEA AREAS AS A
PROTECTIVE MEASURE:
A CASE STUDY OF THE WADDEN SEA PSSA**

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A thesis submitted in partial fulfilment of the requirements of the Nottingham Trent University and Southampton Solent University for the degree of Master of Philosophy

June 2013

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ABSTRACT

Particularly Sensitive Sea Areas (PSSA) are designated by the International Maritime Organisation in order to offer protection to marine areas that are vulnerable to the impacts of international shipping and maritime activities. The concept of PSSAs dates back to 1978, however it was not until 1990 that the Great Barrier Reef became the first designated PSSA. Since then the guidelines for designation of an area as a PSSA have been amended several times. However the question of whether designated PSSAs are afforded greater protection from shipping is debateable. This research attempts to establish whether the PSSA designation is an effective protective mechanism. This was investigated by undertaking an evaluation of the Wadden Sea PSSA, which was designated in 2002.

A framework was developed that enabled an evaluation of the Wadden Sea PSSA. To develop the evaluative framework existing international and regional environmental protection agreements, such as the Convention on Biological Diversity and IUCN Marine Protected Areas were reviewed to identify the processes involved for identification and assessment of protected areas. The findings of this exercise informed the choice of the pressure, state, response basis for the evaluation and the identification of an indicator suite in order to assess the environmental quality of the area. Indicators utilised were those that had a clear shipping signal and which were also of high relevance to the Wadden Sea PSSA.

The findings of the evaluation of the Wadden Sea were somewhat inconclusive. Whilst the Wadden Sea has been monitored for environmental quality for many years and appears to be in a healthy state it is unclear whether this is directly linked with the designation of the area as a PSSA and/or the suite of other multiple protective designations currently in place. With respect to the PSSA specifically, there was no baseline data which could form the basis of a detailed spatial or temporal analysis, there was disparity and inconsistency of data available and a general lack of data with a clear shipping signal. From the evaluation undertaken it was clear that major issues when trying to measure the effectiveness of a PSSA were firstly, the lack of requirement for undertaking a comprehensive risk analysis of the proposed PSSA prior to designation which would provide clear and appropriate baseline data. Secondly, the lack of a formal monitoring and assessment programme to be instigated at the time of designation, which would ensure appropriate data was available for temporal and spatial analysis. Finally a major issue related to the lack of stakeholder knowledge and understanding of the

location, function and purpose of a PSSA once the designation had been agreed and put in place.

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ABBREVIATIONS

APM	Associated Protective Measure
AIS	Automated Identification System
BRIC	Brazil, Russia, India, China
CWWS	Common Wadden Sea Secretariat
Dwt	Deadweight tonnage
FoEI	Friends of the Earth International
GDP	Gross Domestic Product
GESAMP	Group of Experts on the Scientific Aspects of Pollution
IMCO	Inter-Governmental Maritime Consultative Organisation
IMO	International Maritime Organisation
ITSP	International Conference on Tanker Safety and Pollution Prevention
IUCN	International Union for Conservation of Nature
LDC	London Dumping Convention 1972
MARPOL	International Convention for the Prevention of Marine Pollution by Ships 1973, as modified by the Protocol of 1978, relating thereto
MEA	Multilateral Environmental Agreements
MEPC	Marine Environmental Protection Committee
MPA	Marine Protected Area
NMP	National Marine Parks
OECD	Organisation for Economic Co-operation and Development
OILPOL	International Convention for the Prevention of Pollution of the Sea by Oil 1954
OUV	Outstanding Universal Value
PSSA	Particularly Sensitive Sea Area
QSR	Quality Status Report
SA	Special Area (MARPOL)
SAC	Special Area of Conservation
SPA	Special Protected Areas
SPREP	South Pacific Regional Environmental Programme
TBT	Tributyltin
TMAG	Tri-Lateral Monitoring and Assessment Group
TMAP	Trilateral Monitoring and Assessment Programme
TSSP	Tanker Safety and Pollution Prevention

UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Education, Scientific and Cultural Organisation
UNEP	United Nations Environmental Programme
UNCTAD	United Nations Conference on Trade and Development
WHC	World Heritage Convention
WSSD	World Summit on sustainable Development

CHAPTER 1

INTRODUCTION

1.0 Introduction

Approximately 71% of the Earth's surface is covered by oceans and seas and contained within them are 50% of the world's species (NOAA, 2012). The oceans and seas are closely linked to many of the Earth's major systems such as climate and weather and are a key source of protein for much of the Earth's population; they are also vital for international trade and commerce with shipping transporting approximately 90% of world traded goods (Marisec, 2011). Therefore protection of the marine environment from pollution and degradation should be seen as an imperative for all nations.

The United Nations Conference on the Environment in 1992 highlighted the need to instigate management related activities to prevent, reduce and control degradation of the marine environment from both land and sea based activities, including shipping within Agenda 21, Chapter 17¹. Since this time many International and National organisations have worked towards meeting the requirements of Agenda 21, Chapter 17. As a result a number of legislative frameworks have been developed, all with the common aim of protecting the most vulnerable areas. Vulnerability of an area can be defined as the sensitivity of an area to both anthropogenic and natural stresses, how the area responds to those stresses and the probability of an area being exposed to those stresses (Zacharias & Gregr, 2005). With regards to the marine environment a variety of instruments exist which aim to protect vulnerable areas from the impacts of multiple sources including: human activity, land based pollution and run-off, maritime activity (offshore and onshore exploration and exploitation) and shipping. Key designations in Europe include *inter alia* National Marine Parks (NMP), Special Protected Areas (SPAs), Special Areas of Conservation (SACs), World Heritage marine sites, Ramsar designations, Marine Protected Areas (MPAs), Special Areas (SA) and Particularly Sensitive Sea Areas (PSSAs). These designations have been developed from an array of global conventions² and are governed by a range of organisations and legislation,

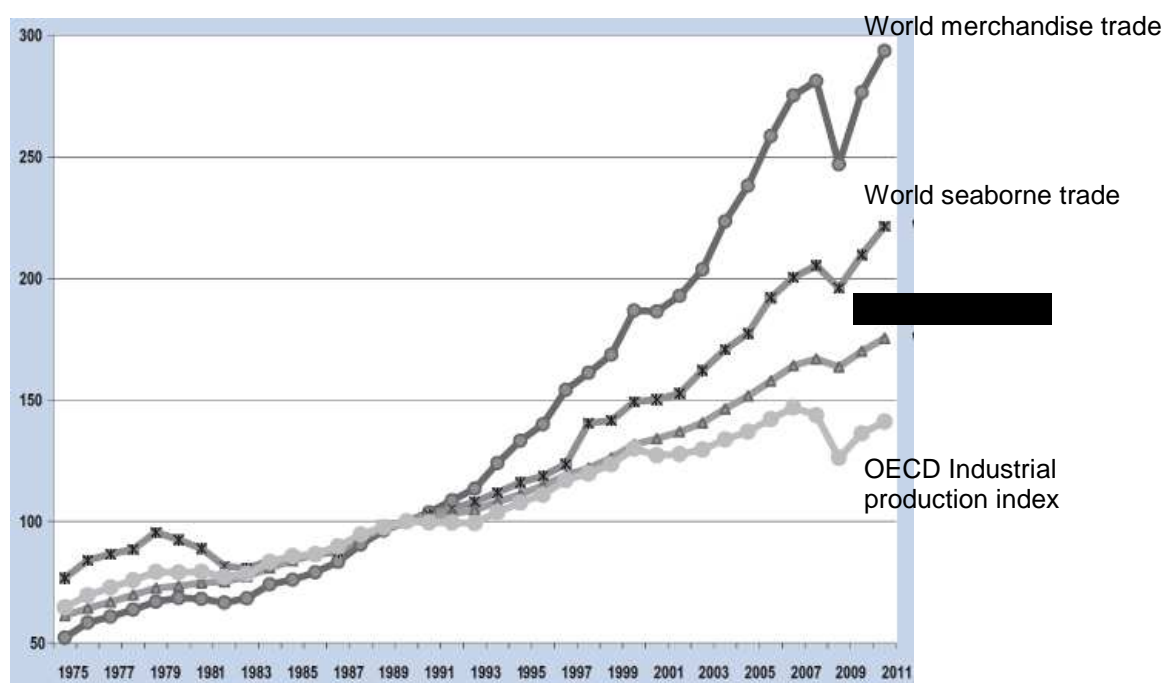
¹ Chapter 17. Protection of the Oceans, all kinds of seas, including enclosed and semi enclosed seas, and coastal areas and the protection, rational use and development of their living resources

² E.g. London Dumping Convention (LDC), International Convention for Prevention of Pollution from ships (MARPOL 73/78), Convention on Biological Diversity (CBD), Conservation and Management of Straddling Fish Stock and Highly Migratory Fish Stocks (United Nations Fish Stocks Agreement), Convention for the Protection of the Marine Environment of the North east Atlantic (OSPAR Convention), Convention for the Protection of the Marine Environment and the Coastal Region of the

thereby enabling protective mechanisms including ‘no take’ fishery zones, no discharge areas and prohibition of recreational activities to be put in place and enacted within national laws.

Shipping provides the global arteries of commerce, with approximately 90% of the world’s major commodities being transported by sea. Ships are also considered to be the most environmentally benign form of transport when considering a tonne/mile³ basis. However they also have the potential to cause potentially devastating damage to the marine environment through pollution, be it operational, accidental or intentional. The economic development and growth of the BRIC⁴ countries, and the consequent increase in demand for raw materials and consumer goods between these countries and the West, has resulted in a substantial increase in maritime trade over the past 20 years (Figure 1). Although the recent recession saw a decrease in world and seaborne trade in 2008, signs of recovery are clearly evident and growth is likely to continue, with both world and seaborne trade figures for 2011 already above those of 2007.

Figure1. World merchandise trade, seaborne trade, GDP and OECD Production index 1975 – 2011 (UNCTAD, 2011, p. 4)



Mediterranean (Barcelona Convention) Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Agreement), EU Habitats and Birds Directive (Natura 2000)

³ A measure of ‘transportation work’ equal to one tonne of cargo carried over a distance of one mile

⁴ Brazil, Russia, India, China

This steady growth in trade over the past 20 years has led to an associated increase in shipping movements and shipping tonnage (Table 1). Ships have also become larger, in some sectors, in order to benefit from economies of scale, whilst manning levels on ships have tended to be reduced with the introduction of labour saving and assistive technology on board vessels. At the same time mariners are under pressure from shipping companies to meet increasing deadlines, in order to maximise cargo distribution and tonnes carried; they are also under pressure to ensure that they comply with a raft of legislation pertaining to safety, security and protection of the marine environment. The associated administrative burden is expected to be delivered without any additional manning on board the vessels to account for the extra hours needed or additional training that may be required in order to complete tasks and comply with company and industry regulations. All of these factors can be seen as additional stresses that can have an impact with respect to the safe passage of vessels, which should be seen as an imperative to ensure protection of the marine environment and the success of any mechanisms implemented to protect the marine environment from degradation due to shipping and maritime activities.

Table 1. World fleet and cargo transported. Growth 1990 – 2010 (UNCTAD, 2011)

	1990	2010
World fleet (million dwt)	683	1396
Cargo transported (million tons)	4,008	8,408

With regard to protection of the marine environment from the impacts of shipping, key issues relate not only to the vessels themselves, but also to the variety of instruments and tools in place and the way in which protective measures are assessed, managed and implemented (locally, nationally and internationally). By its very nature, unlike the terrestrial environment, there are few physical boundaries within the marine environment and impacts can transfer across great distances with little ability to prevent this movement. The issue of preventing trans-boundary migration⁵ of some pollutants from shipping and prevention of environmental degradation from a major incident⁶ are addressed by the International Maritime Organisation (IMO) through the ongoing development and introduction of regulatory control, such as the International Convention for the Control and Management of Ships Ballast Water and Sediment

⁵ E.g. Transfer of invasive species in ships ballast water and noxious substances in ships emissions

⁶ E.g. Exxon Valdez (1989), Sea Empress (1996), Erika (1999), Prestige (2002)

(Adopted 2004) and amendments to existing regulations such as the International Convention for Prevention of Pollution from ships, 1973 as modified by the Protocol of 1978 (MARPOL) and the International Convention for the Safety Of Life At Sea (SOLAS) 1974. However it is suggested that the ability to effectively protect the marine environment may be compromised by an overall lack of knowledge and understanding of marine environmental issues amongst mariners, ship owners and operators. Furthermore the complexities of legislation and enforcement of regulations across such an extensively diverse international arena, with a multitude of stakeholders, add to the problems which need to be overcome.

In order to give credibility and validity to designations designed to protect the marine environment from shipping, it is argued that there is a need to measure and assess their effectiveness as protective mechanisms and also to identify how they are perceived, acknowledged, managed and are implemented by States, mariners, shipping companies and other major stakeholders operating within the marine environment.

At the start of this research process the initial aim was to undertake a critical analysis of the strengths and weaknesses of existing marine environmental protection regimes from shipping and related marine activities, in order to assess their effectiveness as protective mechanisms. During the initial literature searches it became apparent that the research should be more focused with the emphasis placed on Particularly Sensitive Sea Areas (PSSAs), the only mechanism specifically related to international shipping and which allows a country to extend protection beyond the limits of its national jurisdiction as proscribed by the United Nations Convention of the Law of the Sea, 1982 (UNCLOS). Furthermore this is also the only mechanism that exists which enables a country to put in place protective measures, under the auspices of the IMO, that relate directly to shipping and which has a legal basis outside a State's territorial sea.

Currently 13 PSSAs and 1 extension exist (Table 4, p26); however since 2005 only 3 areas have been identified, the latest being the Saba Bank, in 2012 (IMO, 2012). There has been much criticism and debate over some of the earlier PSSAs with respect to their appropriateness (Johnson, *et al.*, 2005; Roberts, Tsamenji, Workman, & Johnson, 2005; Detjen, 2006; Uggl, 2007; Bateman & White, 2009), with a general feeling that some areas were identified for reasons other than to afford protection of the identified area from shipping. It is evident that questions can be asked which relate not only to the

appropriateness of some identified areas but also whether identification of an area as a PSSA actually provides additional protection to the marine environment from the threats posed by international maritime activity. The question with respect to appropriateness has been addressed by many academics. However the question of how effective PSSAs are as a protective mechanism has not been addressed⁷.

1.1 Aim of Research

At an early stage of this research process an opportunity arose which would enable an in-depth investigation of an existing PSSA to be undertaken; namely, an evaluation of the effectiveness of the Wadden Sea PSSA designation. This provided the ideal opportunity to undertake a case study and for developing and testing a methodology that could be utilised to evaluate the effectiveness of PSSAs as protective mechanisms. It enabled investigation into whether the issues of a designation being effective or not could be attributed to the way in which a designation was assessed, monitored and managed. In order to develop an understanding of the role of assessment and monitoring for successful environmental protection additional background research was required, entailing a review of other protective measures and how they are implemented and managed. Therefore the aim of the research was to undertake:

An evaluation of Particularly Sensitive Sea Areas (PSSAs) to establish their effectiveness as a protective mechanism from international shipping activities.

In order to meet the aim the following research objectives were set:

1. Describe the role of the IMO in marine environmental protection and the development of and guidelines for the designation of Particularly Sensitive Sea Areas
2. Review existing terrestrial and marine environmental protection regimes to establish the accepted approach for effective environmental protection
3. Identify and develop a methodology that can be utilised in order to evaluate the effectiveness of a Particularly Sensitive Sea Areas
4. Evaluate an existing Particularly Sensitive Sea Areas to test the methodology developed

⁷ Recent discussion at MEPC 65/22, Agenda item 9, document presented by WWF and IUCN (May 2013)

5. Propose ways in which current Particularly Sensitive Sea Areas designations can be enhanced in order to provide more effective protection to the marine environment

1.2 Structure of report

This report comprises 8 chapters. Chapter 1 provides the rationale for the research and states the aim and objectives. Chapter 2 describes the role and development of the IMO and reviews the development of the guidelines for designation of PSSAs, highlighting key issues. Chapter 3 provides a chronological review of major international environmental conventions, treaties and agreements that can be seen as exemplar and which have a marine element. The review includes discussion pertaining to how the areas are designated and managed. Chapter 4 evaluates the importance of environmental monitoring and assessment with regard to successful management of protected areas, identifying some of key methods available. Chapter 5 sets out the methodological approach and methodology. Within this chapter the methodology identified and utilised for the case study to evaluate the effectiveness of the Wadden Sea PSSA is also discussed together with limitations. Chapters 6 and 7 comprise the case study of the Wadden Sea PSSA and present the evaluation findings. Chapter 8 discusses the issues and lessons learnt from the case study in relation to the wider context. Chapter 9 offers conclusions and recommendations.

1.3 Timeframe of research

This research was undertaken between November 2008 and January 2013, with the evaluation of the Waddensee Particularly Sensitive Sea Area being undertaken from May 2009 to November 2009.

CHAPTER 2

THE IMO AND PROTECTION OF THE MARINE ENVIRONMENT

2.0 Role and Development of the International Maritime Organisation

Prior to the development and recognition of an internationally recognised over-arching body, countries and nations were generally responsible for the development and implementation of their own maritime laws and regulations regarding shipping, as such there existed a great disparity in standards across the maritime world. In 1948, the United Nations adopted the Convention which created the Inter-Governmental Maritime Consultative Organisation (IMCO), to establish an international framework regulating the safety of shipping. In 1959, IMCO was formally recognised and accepted as a specialist agency of the United Nations, and became the ‘competent international organisation’ for maritime affairs. The remit of IMCO was:

"To provide machinery for co-operation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade, and to encourage the general adoption of the highest practicable standards in matters concerning maritime safety and efficiency of navigation" Article 1 (a) Convention on the International Maritime Organisation 1948 (IMO, 2002a)

The 1948 Convention on the International Maritime Organisation made no reference to protection of the marine environment and pollution (IMO, 2002a), concentrating on issues relating to maritime safety and efficiency of navigation. IMCO became known as the International Maritime Organisation (IMO) in 1982 and today consists of 170 Member States and 3 Associate Members (IMO, 2013).

The work of the IMO today has extended beyond the original remit of maritime safety and efficiency of navigation and Article 1(a) of the original convention was amended in 1975 to include *"the prevention and control of marine pollution from ships; and to deal with legal matters.."* This change came about as a direct result of the grounding of the Torrey Canyon in 1967, which highlighted not only the devastating effect of a major oil spill on the marine environment, but also some major deficiencies relating to liability

and compensation with respect to a pollution incident. At this time the Marine Environmental Protection Committee (MEPC) was created as a subsidiary body of the Assembly to consider issues relating to prevention and control of pollution from shipping within the marine environment. The Legal Committee, which deals with legal matters falling within the remit of the IMO, was also given greater standing within the organisation at this time.

2.1 Prevention of pollution from ships

The first recognised conference to address issues of ship borne pollution of the marine environment from oil took place in London in 1954; this led to the development and adoption of the International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL) 1954 (IMO, 2011a). This Convention was primarily aimed at oil pollution from tanker operations and discharges of oily waste from machinery spaces. However the regulations were not particularly stringent, stipulating prohibition of discharges 50 miles from the nearest shore and oily water discharge limits of 100ppm. Furthermore it also set out a requirement for contracting States to provide for ‘adequate reception facilities’ for oily water waste and residues (OILPOL, 1954).

2.1.1 Ships routeing and Areas to be avoided

Ships routeing is an IMO instrument which was initially implemented to prevent collisions and groundings in congested waters dating back to the original Safety of Life at Sea Convention in 1914. Within the International Convention for Safety of Life at Sea (1974) Chapter 5 it now states:

“Ships’ routeing systems contribute to safety of life at sea, safety and efficiency of navigation and/or protection of the marine environment.” (SOLAS Ch5/10.1)

Any request for a ships routeing measure must meet criteria set by the IMO and be passed to the subcommittee on Safety of Navigation for evaluation prior to adoption (IMO, Ships Routeing, 2011b). Once a measure has been adopted it then becomes mandatory for all vessels to comply with the routeing measure. Ships routeing options are dependent on locality and traffic characteristics and include measures such as traffic separation schemes, two way routes, recommended tracks, deep water routes, precautionary areas and Areas to be avoided (*ibid.*).

Areas to be avoided could be said to be the first form of protection offered to a specific marine area, with clearly defined limits, that addressed dangers and potential harm to the marine environment directly associated with shipping. These areas are those that have been identified as being particularly sensitive with respect to ecological and environmental factors or areas that pose exceptional dangers to shipping. These areas should be avoided by all ships or certain classes of ships (i.e tankers or vessels carrying dangerous goods) (SOLAS, 2009)

2.2 The International Convention for the Prevention of Marine Pollution by Ships 1973, as amended by the Protocol of 1978 (MARPOL)

The grounding of the Torrey Canyon led to the development of additional areas being addressed by IMCO, as proscribed in the 1948 convention, and an associated review of OILPOL 1954, in order to respond to changing attitudes with regard to protection of the marine environment from shipping (IMO, 2002b). The high level of pollution experienced⁸ after the grounding, led to increased pressure to address technical issues related to pollution prevention. Even though the results of spills caused by accidents was devastating, at this time the focus remained on reducing operational pollution. Therefore the amendments to OILPOL 54 in 1969 related to operational discharges only. However with the growth of maritime trade, particularly the increasing volume of oil and chemicals being transported by sea, it was felt that these amendments alone were not adequate and that a completely new convention was required to address the issue of pollution prevention, that went beyond operational discharges and pollution associated with oil only (*ibid*). An international conference was called and at the same time the sub committee on Oil Pollution was renamed the sub committee on Marine Pollution, now the Marine Environmental Protection Committee (MEPC).

The initial conference in 1973, failed to gain agreement amongst contracting States with some feeling that the desire to address other forms of pollution from shipping, with the inclusion of an additional four annexes⁹ was unnecessary. Agreement was finally met in 1978, when member States were allowed to become party to the convention by signing up to Annex I (relating to oil), followed three years later by Annex II (noxious substances carried in bulk). The International Convention for the Prevention of Marine

⁸ The Torrey Canyon ran aground in the English Channel on 18 March 1967, losing her entire cargo of 120,000 tons of crude oil

⁹ Additional Annexes addressed: Annex III - Harmful Goods in Packaged Form, Annex IV -Sewage and Annex V -Garbage

Pollution by Ships 1973, as modified by the Protocol of 1978, relating thereto (MARPOL 73/78) entered into force in 1983.

2.2.1 Identification of Special Areas

The concept of Special Areas (SA) was first put forward at the 1973 conference. Special Areas are deemed particularly vulnerable to discharges and pollution that fall under of specific Annex of the MARPOL convention. A Special Area is defined as a sea area where:

“...for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required. Under the Convention, these special areas are provided with a higher level of protection than other areas of the sea.” (IMO, 2010)

Initially these areas were those identified as being particularly vulnerable to the impacts of oil pollution (MARPOL Annex I), where a total ban on the discharge of any oil/oily waste was required to protect the marine environment. The first major sea areas identified as Annex I Special Areas were: the Mediterranean, the Baltic Sea, the Black Sea, the Red Sea and the Gulfs Area. Since their initial inception where Special Areas were associated only with Annex I, the concept has evolved to afford protection through discharge prohibition and restrictions relating to Annex II (Noxious substances), Annex IV (Sewage), Annex V (Garbage) and Annex VI (Air pollution) of MARPOL.

2.3 Development of the Particularly Sensitive Sea Area

The concept of the PSSA was an initiative put forward by the Swedish contingent at the 1978 International Conference on Tanker Safety and Pollution Prevention (TSPP). At this conference the Swedish delegation proposed that special protection should be afforded to ‘...areas of particular value because of their renewable natural resources or their importance for scientific purposes.’ (Peet, 1994, p. 475). At this time it was suggested that a study be undertaken in order to make an inventory of potential areas, identifying why they needed protecting and what measures should be considered to afford protection to the area. It was also explicit that while the concept should be a separate entity to the existing MARPOL Special Areas concept, they should be complementary and not mutually exclusive.

The concept was accepted by the TSPP conference under Resolution 9 (Appendix G) and was reviewed by the MEPC in May of the same year. At this time the MEPC brought Resolution 9 to the attention of the London Dumping Convention (LDC), which provided the framework for regulation of ocean dumping, and the Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), a joint advisory committee of the UN. The GESAMP team reviewed the requirements of Resolution 9 (b,i)¹⁰ and felt that it would not be appropriate for them to undertake an inventory of potential areas, however they suggested that they could provide MEPC with scientific advice in order to help develop a set of guidelines for identification of potential areas. The LDC felt that protection of particularly sensitive areas was already being addressed under Annex III¹¹ of their convention. (Peet, 1994). However whilst consideration of the elements contained within Annex III is essential, it is questionable that their use alone can be said to provide adequate protection to particularly sensitive areas. (For full requirements of Annex III of LDC see Appendix H)

After the initial surge of activity and interest very little progress was made until 1986, after the acceptance of a submission by Friends of the Earth International (FoEI) at MEPC 22 (December 1985) to include the concept on the agenda at the 23rd session of the MEPC¹². At this time both FoIE and the International Union for the Conservation of Nature and Natural Resources (now the IUCN) submitted papers identifying and discussing the possible way forward for developing the PSSA concept (Roberts, 2007). It should be noted that initially the majority of the proponents for the development of the concept were Non Governmental Organisations (NGOs). Many Member States could not see the benefit of the concept, with several delegates putting forward the case for incorporating the concept within existing IMO instruments such as the MARPOL convention, rather than creating a new designation. In order to progress the concept a working group was instigated to further investigate the potential of the idea, including how and where an area could be identified and on what basis. The result of which was the decision of the MEPC to instruct delegates to start collecting information that could

¹⁰ Resolution 9, (b.i): making an inventory of sea areas around the world which are in special need of protection against marine pollution from ships and dumping, on account of the areas' particular sensitivity in respect of their renewable

¹¹ Annex III provides technical information pertaining to characteristics and composition of the matter being dumped, characteristics of the dumping site and method of disposal and general considerations and conditions (LDC, 1972)

¹² Up to this point, whilst the issue of Particularly Sensitive Sea areas was placed on the agenda for discussion at the next MEPC meeting several times, it never managed to actually make the agenda, indicating an initial reluctance to pursue the concept.

be used to develop criteria in order to identify potential areas (MEPC 23/16/3) based on: maritime activity, geographic location, national restrictions and protection measures, as applicable under UNCLOS or within the remit of the IMO (Peet, 1994).

By the 25th session of MEPC in November 1987 documents were received from several Member States and NGO's which enabled the working group to reconvene and to be presented with terms of reference to:

- Establish criteria for the designation of Special Area status
- Formulate a definition for Particularly Sensitive Sea Areas
- Develop a set of general criteria which could be applied to determine which marine areas are particularly sensitive
- Develop a set of specific criteria which would be more technical in nature in that they would need to be supported by marine scientific research
- Identify appropriate regulatory measures in the maritime field for the protection of sensitive areas
- Identify Particularly Sensitive Sea Areas beyond the territorial seas using the criteria developed with a view to establishing an inventory of such areas.

(MEPC 25/WP 14)

Up until this point there were no specific criteria for the designation of Special Area status. It would appear that the case for specific criteria was in order to ensure that the criteria used for identifying PSSAs could be clearly differentiated from those of Special Areas. The issue of separate criteria is of particular relevance through the evolution and amendments to the Guidelines, which in their latest format of 2005, have seen the two protective mechanisms being treated as two separate entities, as was suggested in the original initiative of 1978. Two further points of interest can be identified at this time. Firstly, at no time during the discussion and development stages was the need for assessment and monitoring of potential areas recommended or suggested as being of importance or a required criterion. Secondly, at this time a number of delegates suggested the possibility that the introduction of too many protected sea areas may lead to the '...disorientation and bewilderment of seafarers' (Peet, 1994, p. 480).

In 1990, at MEPC 29 the first draft guidelines for the 'Identification of Special Areas and Particularly Sensitive Sea Areas' was presented by FoEI. The progression, and

development of these guidelines were somewhat steamrolled through MEPC by the submission from Australia for the identification and designation of the Great Barrier Reef as a PSSA. This was not the first time that Australia had been so proactive with respect to protection of the Great Barrier Reef, which had already been afforded specific protection *avant la lettre*¹³ in 1973 by the IMO. At which time it was decided that ‘nearest land’ was the outside of the reef, thereby enabling prohibition of discharges of oil and oily waste in the area under the MARPOL regulations (Ottesen *et al.*, 1994; Peet, 1994). The 1990 submission was successful and saw the Great Barrier Reef being designated as a PSSA in November, before the guidelines had been officially adopted by the IMO. Resolution A.720 (17) ‘Guidelines for the Designation of Special areas and the Identification of Particularly sensitive Seas Areas’ was formerly adopted in November 1991 at the 17th Session of the IMO Assembly.

2.4. Development of PSSA guidelines

Since the original guidelines were adopted and published by the IMO in 1991, they have undergone a series of amendments and modifications. The following section outlines the development of the guidelines followed by discussion of the changes made.

2.4.1. Resolution A.720 (17) and A.885 (21)

The original IMO guidelines, Resolution A.720 (17), superseded by Resolution A.885 (21), for designating an area as a PSSA, both stipulated that an integral part of the application should show ‘Vulnerability of the area to damage by international maritime activities’. They further stipulated that an application should provide an explanation of the nature and extent of risk, should describe on-going or future international maritime activities that are causing or could cause damage and the degree of harm that may result either from such activity alone or in combination with other potential threats. The information required included:

- Types of maritime activities in the proposed area
- Evidence that these activities are causing damage and whether damage is of a recurring or cumulative nature
- Nature and volume of international vessel traffic
- Types of cargo carried by such traffic
- Prevailing oceanographic and meteorological conditions

¹³ *Avante la letter*: Before the term/phrase existed – in this case PSSA

- History of groundings, collisions, or spills in the area and any consequences of such incidents
- Any foreseeable circumstances or scenarios under which significant damage could occur

Once activities and risk of damage had been identified additional information on the potential harm that may be expected as a result of these activities, including environmental characteristics and potential economic loss, were also required (Resolution A.885(21) 3.2.2.3).

Within Resolution A.720 (17) protective measures that could be used for a PSSA designation were contained in Chapter 3, which listed existing IMO instruments that could be adopted such as designation of 'Special Areas' under Annexes I,II or V of MARPOL, ships routing measures, compulsory pilotage and vessel traffic management systems (available through SOLAS Ch 5). An allowance was also made for implementation of a measure that whilst not recognised at the time by IMO may be adopted at a future date. Resolution A.885 (21) ameliorated chapter 3 (Protective measures) of Resolution A.720 (17) and reiterated clearly the requirement for a PSSA proposal to be submitted in conjunction with any APMs to be implemented. These APMs could be any measure already available in existing instruments, any measure that does not exist but should, and falls within IMO competence, or any measures pursuant with Part XII (section 5 & 6)¹⁴ of the UNCLOS covering territorial seas and exclusive economic zones (UNCLOS,2012). Furthermore any APMs adopted should be tailored to meet the needs of the area and should specify the category of ship they are aimed at.

2.4.2. Resolution A 927(22) and A982 (24)

Since the amendments to the guidelines in 1999 Resolution A 885 (21), there were no submissions for the identification and designation of any additional PSSAs. The poor take up could have been linked with the issues that were faced by Cuba during the process of designation of Saba Camaguey as a PSSA, which became a long and drawn out process, with several issues relating to interpretation of the guidelines and lack of clarity (Gjerde, 1999). The MEPC were invited to review the guidelines in order to try and encourage Member States to utilise the designation. Once again the guidelines underwent a process of re-writing in order to try and address these issues. A key change

¹⁴ Addresses International and National legislation and enforcement pertaining to the protection and preservation of the marine environment

was the clear separation of the guidelines for Special Areas and those for PSSAs (Resolution 927(22) Annex 2, 1.1). Furthermore there was a change of wording with respect to ‘vulnerability from international shipping’ (Resolution 927(22) Annex 2, 1.2), previously this vulnerability was to be demonstrated with respect to ‘international maritime activities’, which was open to many different interpretations. These amendments had the desired effect with 5 new PSSAs identified and designated between 2002 and 2004.

A further revision was made to the guidelines in 2005, in line with the on-going review process of the guidelines by the MEPC. It was recognised that there was “the need to clarify and, where appropriate strengthen certain aspects and procedures for the identification and subsequent designation of Particularly Sensitive Sea Areas and the adoption of associated protective measures” (Resolution A.982 (24) p2; Appendix K). This resulted in the adoption of Resolution 982 (24), the latest guidelines for identification of PSSAs. Between 2005 and 2012 a further 6 PSSAs and an extension to the GBR PSSA were adopted. (Table 2)

Table 2 Existing PSSAs (IMO, 2012)

Year	Area	Signatory
1990	Great Barrier Reef	Single
1997	Sabana Camaguey	Single
2002	Malpelo Island	Single
2002	Florida Keys and surrounding area	Single
2002	Wadden Sea	Tri lateral
2003	Paracas National Reserve	Single
2004	Western European Waters	Multi-lateral
2005	Torres Straits – extension to Great Barrier Reef PSSA	Single
2005	Canary Islands	Single
2005	Galapagos Islands	Single
2005	Baltic Sea	Multi-lateral
2008	Papahānaumokuākea Marine National Monument	Single
2011	Straits of Bonifacio	Bi lateral
2012	Saba Bank	Single

2.5 Discussion of Amendments to PSSA Guidelines

2.5.1. Resolution A720 (17) – November 1991

Adopts guidelines for designation of Special Areas and for identification of Particularly Sensitive Sea Areas

Requests MEPC to keep guidelines under review

The initial guidelines had serious failings with regard to interpretation and understanding, particularly when translated. This led to confusion over the differences between Special Areas and PSSAs and also what was required in order to demonstrate ‘vulnerability to international maritime activities’ (Peet, 1994; Gjerde & Pullen, 1998;) There were calls from several NGOs to simplify the guidelines and to present guidelines for Special Areas and PSSAs as two separate documents (De La Fayette in Roberts, 2007. P92). Additionally the guidelines were also criticized for being too long and complicated, (Peet, 1994: Uggla, 2007)

2.5.2. Resolution A885 (21) – November 1999

Adopts new procedures for the Identification of Particularly Sensitive Sea Areas and the adoption of Associated Protective Measures to supersede those contained within Annex I to Res A720 (17)

The amendments to the guidelines adopted clearer wording in order to avoid ambiguity and also re-iterated the need for Associated Protective Measures (APM) to be submitted with any application for a PSSA. New procedures for the identification of PSSAs and also procedures for the adoption of ships routing measures for environmental reasons superseded those within A 720 (17). The new procedure for identification of a PSSA now consisted of two clear stages. Firstly, a description of the area including environmental characteristics and an assessment of vulnerability to international maritime activities; secondly a justification of the APM (Roberts, 2007).

2.5.3. Resolution A927 (22) – November 2001

Adopts new guidelines for designation of Special Areas and Identification of Particularly Sensitive Sea Areas

Revokes A885 (21) and A 720 (17)

As a requirement of the original resolution of 1991, MEPC were required to continually review the guidelines, this review was also possibly undertaken due to the poor take up of the PSSA concept and it was hoped that this revision would increase uptake of the concept (Detjen 2006: Uggla 2007). Under this review the wording of the guidelines were further refined with much of the preamble of the original guidelines being omitted.

For the first time the guidelines also clearly differentiated between Special Areas and PSSAs by creating two separate annexes. Annex 1 containing guidelines for Special Areas and Annex 2 guidelines for PSSAs (Roberts, 2007). A further interesting change was that of the wording relating to demonstrating vulnerability, which previously had been ‘vulnerability to international maritime activities and now appeared as ‘vulnerability from international shipping activity’

2.5.4. Resolution A 982 (24) – December 2005

*Adopts revised guidelines for identification of Particularly Sensitive Sea Areas to
Revokes Annex 2 of A 927 (22)*

One change within Resolution A.982 (24) is the *implied* requirement that at the time of designation of a PSSA, an associated protective measure (APM) that addresses the identified vulnerability should be included (Resolution A.982 (24) para 1.2) (Butt *et al.*, 2010). Whilst there existed a requirement for justification of an APM within the earlier guidelines, there was no specific requirement for an APM to be included within a submission.

Furthermore, within the concept of the PSSA, there exists no requirement to have in place or to produce an environmental management plan. There is only a requirement to identify vulnerability and sensitivity of the area at the time of the application; furthermore there is no specific requirement to monitor the environment after designation, or to conduct further assessments of the state of the environment. So the following questions can be raised:

- Is meeting the criteria as set down in the PSSA guidelines merely a compliance exercise, leading to a designation in name only and being of limited protective value?
- Should the guidelines be modified to enable an assessment and monitoring programme to be put in place at the time of application for designation?

2.6 Summary

The development of PSSAs took place over an extended period of time, from initial identification of the need for such a protective mechanism in 1978 to the adoption of the first set of guidelines in 1991. It is also clear that a constant process of review was required to address issues within the guidelines, resulting in a series of amendments. Key issues related to the fact that the during the process there was continual confusion caused by the fact that initially designation of Special Areas and identification of

PSSAs were contained within a single document, until being separated into their own Annex in 2001.

This intrinsic difference between a Special Area and a PSSA is clear. A Special Area provides additional protection to a designated area through the implementation of prohibitions that are directly linked to a specific MARPOL Annex, i.e. Prohibition of overboard discharge of sewage (MARPOL Annex IV) or garbage (MARPOL Annex V), or exclusions of vessels burning high sulphur oils (Annex VI) within a designated Sulphur Emissions Control Area (SECA). Prohibitions within a Special Area are mandatory. Whereas identification of an area as a PSSA enables special measures (APMs), available through the IMO, to be put in place to address a specific vulnerability from maritime activity, i.e. designation of a traffic separation scheme in heavily trafficked areas or the requirement for compulsory pilotage for ‘high risk’¹⁵ vessels transiting the area (IMO, 2002b; IMO, 2011). It is these measures which provide the legal basis for a PSSA, not the designation itself (Roberts, 2007; Johnson, 2009, pers comm).

Furthermore, the criteria used for qualification and the wording within the documents caused many to either confuse the two designations or to use the identification of PSSAs inappropriately, particularly as the issue of demonstrating vulnerability was not clear cut. Throughout the process of development and as amendments were being made to the guidelines, no mention was made of a requirement for assessment and monitoring to take place, even though a key benefit of PSSA designation would enable comprehensive management of the area to afford protection from identified vulnerabilities (Roberts, 2007).

¹⁵ e.g. Loaded oil tankers or chemical carriers

CHAPTER 3

INTERNATIONAL AND REGIONAL ENVIRONMENTAL PROTECTION AGREEMENTS

3.0 Introduction

In order to establish accepted approaches for effective environmental protection, there is a requirement to review key agreements to understand how they developed and how they are managed in order to relate these to PSSAs. This chapter considers selected agreements that have a specific relevance to marine environmental protection, discussed in chronological order and which are deemed exemplary (Appendix A). These were chosen as they are universally recognised, are deemed to have contributed to protection of the marine environment in some way and address a diverse range in terms of size and location. Furthermore they cover single and multi-lateral agreements at many different levels of governance. Whilst many of the agreements can be classed as having a marine element, the extent of such an element varies from singular issues such as resource management (fisheries) or prevention of water pollution to those that address a much wider range of marine environmental issues. The following discussion concentrates on the latter.

3.1 International and Regional Agreements

Protection to the terrestrial environment can be traced back many thousands of years, with the earliest protection being given to sites that were deemed as ‘sacred’ thereby being off limits to human activities. The first recorded area where protection was afforded specifically to protect flora and fauna was designated by Emperor Asoka of India in 252BC. In 684AD, a nature reserve was created on the island of Sumatra by the King of Srivijaya; today 25,000km² of tropical rain forest on Sumatra is still being protected through designation as a World Heritage site (Chape *et al.*, 2008).

Currently there are many agreements, conventions and policies aimed at environmental protection that are governed or administered either at an international, regional or national level. The earliest major international agreement was the Convention Relative to the Preservation of Fauna and Flora in their Natural Sites (London Convention, 1933). This was followed by the Antarctic Treaty in 1959, the first international agreement to preserve and protect an area from mankind and known by treaty signatories as “... a natural reserve, devoted to peace and science.” (NERC-BAS, 2007).

A commonality to the majority of these agreements is that approaches to conservation with respect to the marine element have generally been addressed through adaptation of terrestrial conservation concepts. This adaptation of terrestrial approaches can lead to major issues, particularly with regard to scale, governance and jurisdictional boundaries (Kentchington, 2010), which in the marine environment are not always as clearly defined or physically apparent as on land. Further issues relate to the complexities of linkages and interactions within marine ecosystems, the ability to identify all inputs and their potential impacts (such as land based and point source pollution) and management between countries with adjacent or adjoining marine jurisdictional zones.

3.2 Man and Biosphere Programme - 1970

The Man and Biosphere Programme (MAB) was conceived at the 1968 Biosphere Conference and launched in 1970 by the United Nations Educational, Scientific and Cultural Organisation (UNESCO). The objectives of the programme aimed at promoting and combining the use of scientific co-operation and governance in order to reduce bio-diversity loss, enhance socio-economic and cultural conditions and to improve livelihoods through the development and use of environmentally sustainable practice. In effect the MAB programme was the first concerted worldwide programme to address the issues of sustainable development. Initially 14 project areas were identified covering a range of ecosystems; today 598 sites exist in 117 countries forming the World Network of Biosphere Reserves (UNESCO, 2012a).

Biosphere reserves are defined in Article 1 of the Statutory Framework as ‘...*areas of terrestrial and coastal/marine ecosystems or a combination thereof, which are internationally recognised within the framework of UNESCOs programme on Man and the Biosphere*’ (UNESCO, 2010a). The concept behind and designation of a biosphere reserve is expected to fulfil three basic roles that are complementary and not mutually exclusive to each other, these being:

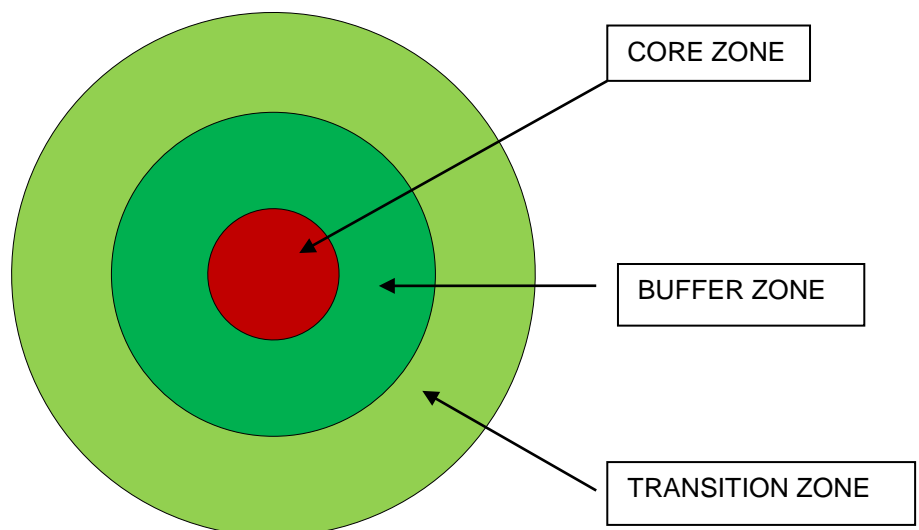
- A conservation function: to contribute to the conservation of landscapes, ecosystems, species and genetic variation
- A development function: to foster economic and human development which is socio-culturally and ecologically sustainable

- A logistics function: to provide support for research, monitoring, education and information exchange related to local, national and global issues of conservation and development (UNESCO, 2010b)

From a management perspective in order to avoid undue conflict and to fulfil the roles of conservation, development and logistics in a complementary way biosphere reserves are made up of three distinct zones; a core zone, a buffer zone and a transitional zone (Figure 2).

The core zone encompasses the most vulnerable area, which will generally be afforded legal protection through national law. Activities within this area should be minimal and limited to monitoring of the area. The buffer zone, which is generally contiguous to the core zone, provides an area in which it is possible to minimise or mitigate potential impacts on the core zone, possibly through protection under national laws. Activities within this area should be carefully managed; however they should not necessarily be totally restrictive. The transition zone provides an extension to the buffer zone where activities, provided they do not have the potential for negative impact on the core and buffer zones, should not be restrictive or detrimental to the socio-economic well being of the area (Roberts, 2007; Chape *et al.*, 2008).

Figure 2. Biosphere zonation (adapted from Chape *et al.*, 2008)



The MAB is a voluntary inter-governmental programme and as such is driven by a countries willingness to participate in the programme, there is no legal framework.

Nominations for biosphere status are through national governments; however an increasing number of nominations are being initiated by local communities. Recently the MAB Co-ordinating Council drew attention to the need to extend the programme to include areas that are under intense human pressure such as wetlands, coastal systems and islands. Whilst this could have led to the potential for confusion and duplication of effort, the MAB programme have addressed this by identifying and encouraging the use of a co-ordinated approach for site based conservation at both the international and national level. A successful example of bilateral co-operation can be seen in Europe through the work of the secretariats of the Bern Convention¹⁶ and Natura 2000. This co-operation is also present on a global scale where 20 designated biosphere reserves also include sites that are protected through the World Heritage and Ramsar Conventions (UNESCO, 2009).

3.3 Convention on Wetlands of International Importance (Ramsar) - 1971

The Convention on Wetlands of International Importance, known as the Ramsar Convention takes its name from Ramsar in Iran, where the convention was adopted in 1971. It is an intergovernmental treaty that provides a framework for national and international co-operation. The mission of the convention is *"the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world"*. (Ramsar, 2010).

Wetlands encompasses a broad range of areas including swamps, marshes, rivers, lakes, estuaries, deltas, wet grasslands, near shore marine areas, tidal flats, mangroves and coral reefs. The term also encompasses man made wetlands such as rice paddies, oases, reservoirs, fish ponds and salt flats. Key to the convention is the concept of sustainable use in conjunction with an ecosystems approach to management in line with sustainable development. The inclusion or identification of conservation management plans and objectives are required for all sites at the time of submission for designation. In 2006 there were 1,853 designated sites, 520 of which had a coastal/marine element (Chape *et al.*, 2008). Today the number of designated wetland sites stands at 2,050 (Ramsar, 2012a)

¹⁶ 1979 Convention on the Conservation of European Birds and Wildlife

Areas that have been identified as Ramsar sites and where changes in their ecological status have occurred or are likely to occur due to technological developments, pollution or human interference are listed on the Montreaux record. Currently there are 48 sites on the list all of which have been identified as priorities for conservation efforts, several of which include estuaries and near shore marine areas¹⁷ (Ramsar, 2012b).

In line with the identified need for co-operation and collaboration amongst Multilateral Environmental Agreements (MEA) the Ramsar secretariat are very active in developing synergies with other environmental instruments. As such they actively encourage Ramsar Administrative Authorities to work closely with and develop relationships on a national level with other conventions. Ramsar has signed memorandums of co-operation with the Convention on Biological Diversity, Convention on the Conservation of Migratory Species and UNESCO World Heritage Convention. On a regional level they co-operate under the Cartagena Convention¹⁸, Barcelona Convention¹⁹ and Secretariat of the Pacific Regional Environmental Programme SPREP. They also have close relationships with UNESCO MAB, European Environment Agency, and the United Nations Food and Agricultural Organisation.

3.4 United Nations Conference on the Human Environment (UNCHE) - 1972

The UNCHE took place in Stockholm in 1972; it was the first United Nations conference to address issues relating to mankind's impact on the environment. The Stockholm Conference is generally accepted as the founder and driver for many of the treaties and conventions relating to protection of the environment that exist today. It clearly recognised the importance of the marine environment and its resources available to humanity and also that the ability of the oceans and seas to assimilate waste and regenerate resources was not unlimited. Key principles of the Stockholm Declaration, resulting from the conference, include a sustainable approach to management and pollution prevention (UNCHE, 1972), which for the marine environment manifested itself through the development of the Regional Seas Programme in 1974 (section 4.6). Recommendation 92 from the conference includes the following statement of objectives:

¹⁷ i.e. Schorren van de Beneden Schelde (Belgium), Dee Estuary (UK), Wattenmeer/Waddensee (Germany)

¹⁸ Convention for the protection and development of the marine environment of the wider Caribbean area

¹⁹ Convention for the protection of the Mediterranean Sea against pollution

“The marine environment and all the living organisms which it supports are of vital importance to humanity, and all people have an interest in assuring that this environment is so managed that its quality and resources are not impaired..... Proper management is required and measures to prevent and control marine pollution must be regarded as an essential element in this management of the oceans and seas and their natural resources”. Resolution 92 (a), Stockholm Declaration on the Human Environment. (UNCHE, 1972).

Furthermore Resolution 92 highlighted the rights of coastal states and recommended that these principles should be taken into account by the Inter-Governmental Maritime Consultative Organisation (IMCO) conference and the Conference on the Law of the Sea during 1973 (Resolution 92: UNEP, 1972).

3.5 World Culture and Natural Heritage - 1972

The Convention for the Protection of the World Cultural and Natural Heritage was adopted in 1972 by the General Conference of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and came into force in 1975. The concept behind the convention is universal in application and maintains that *‘World heritage sites belong to all the peoples of the world, irrespective of the territory on which they are located’* (UNESCO 2008). To date 189 States have ratified the convention (World Heritage List, 2012).

The overriding principle of designation as a World Heritage Site is that of ‘Outstanding Universal Value’ (OUV). Sites of OUV are proscribed under the Convention Operational Guidelines (Section II.A:49), as having cultural and/or natural significance which *‘...is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity...’* (UNESCO, 2008). Cultural OUV may relate to art, history or science or may be based on aesthetic, ethnological or anthropological viewpoints. Natural OUV may relate to science, conservation, aesthetics or natural beauty. In relation to other types of protected areas, designation as a World Heritage Site should be seen as the pinnacle, and as such should be afforded the highest level of protection and management. This is clearly identified under the Conditions of Integrity (section II.E:87-95) and Protection and Management (section II.F:96-119) within the Operational Guidelines. Within these guidelines it is also explicit that appropriate management plans should be included at the time of application (section II.F: 97) and that *‘an effective management system could include*

....a cycle of planning, implementation, monitoring, evaluation and feedback' (UNESCO, 2008; section II.F:111.b). Additionally it is also suggested, in a similar manner to the MAB programme, that the concept of core areas with protective buffer zones (section II:F 103) should be utilised wherever possible.

Currently there are 962 sites on the World Heritage list (745 Cultural, 188 natural, 29 mixed), of these only 46 are classified as marine sites (UNESCO, 2012). (Appendix I). The lack of representation of marine areas in the World Heritage List is a cause for concern in that it fails to fulfil the requirement of a '*...global strategy for a representative, balanced and credible World Heritage List*' (UNESCO, 2008; Section I.F. 28: d). This lack of representation became evident from a study undertaken for the IUCN Natural Heritage Programme in 1997 by Thorsell *et al.*, who noted that whilst wetlands and areas with marine components comprised a total of 77 sites, only 39 of these had a primary wetland/marine component and of these only 28 had a significant marine/coastal element. In order to address this lack of representation a workshop on marine biodiversity was convened in 2002 in Hanoi, in order to try and address how the World Heritage Convention could be used to further conservation and protection of the world's marine ecosystems. As a direct result of this the World Heritage - Marine Heritage Programme was instigated. Key recommendations of the proceedings included:

- Improving the coverage and geographic representation of tropical marine, coastal and small island ecosystems of Outstanding Universal Value (OUV) as World Heritage sites.
- The requirement that Marine World Heritage sites and other marine protected areas must be large enough to include the sources of larvae needed to replenish populations of organisms depleted by disturbances, to encompass important migration routes, and to fully protect viable breeding stocks of species that are endangered or crucial to ecosystem integrity
- Where shipping occurs through or near a World Heritage site, investigations should be initiated to determine whether designation of the area as a Particularly Sensitive Sea Area by the International Maritime Organization would be appropriate.

- More information about ecological components and processes, as well as about proven and effective management practices was needed to guide the management of existing World Heritage sites.
- Sites already on the World Heritage List should provide for improved monitoring and effective management. Capacity building is an urgent requirement in many countries (UNESCO, 2008, pp. 18-19)

With the requirements of any site on the World Heritage List to be representative of OUV, any site that shows significant signs of deterioration or which is threatened by serious and specific danger, is placed on the 'World Heritage in Danger' List (e.g. Belize Barrier Reef Reserve System). Once placed on this list a programme of corrective measures are agreed and the site is carefully monitored. If corrective measures are successful the site will be removed from the danger list, however if conservation efforts are unsuccessful and deterioration is too great the site will be removed completely from the World Heritage list. (Section IV.B- IV.C) (UNESCO, 2008, pp. 47-53)

3.6 United Nations Environmental Programme:

Regional Seas Programme - 1974

The Regional Seas programme (RSP) was established as a result of the 1972 Conference on the Human Environment in Stockholm, falling under the auspices of UNEP. It is significant in the fact that it aims at sustainable management of the marine and coastal environment in order to reduce degradation and encourages collaboration between countries that share a common marine environment. The current major objectives of the programme are to assist in meeting the requirements of Agenda 21, the World Summit on Sustainable Development (WSSD) Plan of Implementation, and targets set for the Millennium Development Goals at a regional level.

There are 18 geographic regions covered by the programme, providing one of the most comprehensive initiatives for protection of the marine environment, representing more than 143 countries. Located within some of these regions are areas identified as Large Marine Ecosystems (LME) which are areas of 200,000 square kilometres or greater that encompass coastal areas, estuaries and river basins and extend to the seaward boundaries of continental shelves, taking into account the influence of major current systems within the areas.

(NOAA-LME, 2009). Key issues addressed by both these programmes include coastal area management; biodiversity and ecosystems; land based sources of pollution; marine litter; shipping and sea based pollution and small islands. 14 of the RSPs now have legally binding agreements in the form of conventions that confirm commitment and a united political will to address common environmental problems through co-ordinated effort (UNEP, 2012).

A common theme of the RSP and associated conventions is the concept of managing issues through an ecosystem approach, often based on LMEs, where driving forces of ecosystem change are assessed through the use of condition indicators and associated management plans can then be developed and implemented. (NOAA-LME,2009).

3.7 United Nations Convention on the Law of the Sea - 1982

The Third United Nations Convention of the Law of the Sea (UNCLOS) was the culmination of nine years work, between 1972 and 1982, involving the participation of over 160 nations and replaced the Geneva Convention which consisted of four treaties²⁰. The UN Law of the Sea Convention was formally adopted in 1994 one year after ratification by the 60th signatory nation. The Convention recognises the rights of all States irrespective of whether they have a coastline or are landlocked, it also declares that the oceans, seabed and resources beyond national jurisdiction are the common heritage of mankind, therefore exploration and exploitation of such areas should be for the benefit of mankind as a whole (Brown, 1994).

The purpose of the Convention is to clearly delineate maritime boundaries and to identify areas and extent of jurisdiction of coastal States; additionally it clearly sets out laws governing freedom of navigation, safe passage of ships, pollution prevention, provisions with respect to exploitation of marine resources (both living and non-living) and rights to freedom of scientific research. Furthermore, in a move away from the earlier Geneva Convention, UNCLOS includes provision for, and specific obligations on, States to protect and preserve the marine environment by clearly identifying their responsibilities and obligations. To date 166 countries have ratified the Convention with Niger being the latest signatory in August 2013 (UNCLOS, 2013).

²⁰ Convention on the Territorial Seas and Contiguous Zone, Convention on the Continental Shelf, Convention on the High Seas, Convention on Fishing and Conservation of Living Resources of the High seas

UNCLOS comprises of 320 Articles and 9 Annexes. Whilst issues pertaining to the environment appear in several different sections the majority of the content pertaining to protection and preservation of the marine environment is contained within section XII, Articles 192 – 237. Major themes within section XII include a change in attitude with regard to regulatory control that accepts the oceans as a finite resource, thereby requiring users of the oceans to adopt a resource management approach. It also aims to try and bring together the often conflicting views and attitudes that arise between those who strongly advocate the rights to ‘freedom of navigation’ and those who wish to protect the marine environment; an area that requires careful consideration and which is responsible for misunderstanding and negativity between environmentalists, the shipping industry and the States whose waters vessels transit (Roberts *et al*, 2005; Detjen, 2006; Roberts, 2007). Key Articles for protection of the marine environment are Article 192, which identifies the general obligations of the coastal State to ‘protect and preserve’; Article 194 which explains measures a coastal States should use to ‘prevent, reduce and control pollution’; and Article 211 which addresses pollution from vessels, allows the adoption of special mandatory measures within a clearly defined area for the prevention of pollution from vessels, if extant rules and standards are deemed inadequate. These rules should ‘....conform to accepted international rules and standards established through the competent international organisation’ (UNCLOS, 2012, Article 21: 5). Article 211 provides the opportunity for coastal States to develop laws to protect discrete areas of their own waters from degradation due to shipping, which could be compared with the underlying concept of a PSSA (Lefebvre-Chalain, 2007).

3.7.1 Relationship between UNCLOS the IMO and UNEP

The role of the IMO in connection with UNCLOS dates back to 1973, where within the Convention (Article 2, Annex VII), the IMO is identified in the ‘list of experts’ with respect to shipping, specifically in the field of navigation and pollution from vessels. This ensures that instruments implemented by the IMO conform to the principles and guidelines of UNCLOS (IMO, 2008). The same article identifies UNEP as the experts in the field of protection and preservation of the marine environment (LOSC, 2010).

3.8 Convention on Biological Diversity - 1992

The Convention on Biological Diversity (CBD) is a binding agreement which was signed at the United Nations Conference on Environment and Development in 1992.

The Convention relates to the use and conservation of biodiversity and, in line with other UN Conventions, maintains that a sustainable approach for use and protection should be adopted. The original agreement of the CBD contained no specific articles relating to marine and coastal biodiversity, however this was noted as a priority issue with respect to Article 8²¹ of the Convention, and was addressed at the first Conference of the Parties in 1995, which saw a policy decision relating to the Conservation and Sustainable Use of the Marine and Coastal Biological Diversity, more commonly referred to as the Jakarta Mandate, being agreed and introduced in the same year (UNEP, 2006).

There is a close relationship between the Regional Seas Programme and promotion of the principles of the Jakarta Mandate of the CBD. The Jakarta Mandate contains guidelines for the management of integrated coastal and marine areas as well as criteria relating to the development and management of marine and coastal protected areas (MCPAs) with specific details pertaining to monitoring and evaluating effectiveness of MCPAs based on an ecosystems approach (UNEP-CBD, 2011)

The CBD defines a MCPA as:

‘..any defined area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna, and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surrounding’ (Secretariat of the CBD, 2004)

3.9 IUCN Marine Protected Areas (MPA)

The first recognised marine area afforded protection is generally accepted as being the Fort Jefferson National Monument in Florida, which was designated as a National Monument in April 1935 by President Roosevelt (WWF, 2005). The original designation covered 18,850 hectares of sea and 35 hectares of coastland. Today the monument is encompassed within the Dry Tortugas National Park, designated in October 1992, which covers an area of 292km² (Wood, 2007a). When comparing the percentage of terrestrial and marine protected areas, a great disparity is evident; in 2005 only 0.5% of marine areas had been afforded protection, compared with 12.9% of the

²¹ Article 8 relates to *in situ* conservation and promotes the development of protected areas to conserve biological diversity and to protect ecosystems

terrestrial environment (Chape *et al.*, 2008, pp. 11-15). Today Marine Protected Areas cover a total of 2.3% of global ocean area, which includes 7.9% of the continental shelf and equivalent areas i.e. those less than 200 meters (TNC, 2012).

These figures should be treated with some caution as the exact context and definition of what constitutes a marine area was, until recently, open to debate. Prior to the publication of new guidelines in 2012²², the IUCN Protected Area Management Categories, did not allow for any clear differentiation between, inter-tidal, coastal and pure marine sites. The IUCN definition of a Marine Protected Area (MPA) that was previously applied was:

“Any area of inter-tidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Kelleher & Kenchington, 1992).

The most recent definition and a ‘marine’ interpretation of IUCN categories (Appendix J) provides a little more clarity:

“A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (IUCN, 2012).

MPAs cover a wide range of biotopes such as coral reefs, sea-grass meadows, salt-marshes, mangroves and ice covered areas. Furthermore there is no definitive nomenclature; as such protected areas can be described in various ways including: marine sanctuaries, marine reserves, marine parks, protected seascapes or wildlife sanctuaries. Size of MPAs can vary, with the majority being less than 5 square kilometres whilst the largest to date encompasses the Republic of Kiribati which extends over 410,000 square kilometres. The Great Barrier Reef (344,360 km²) and the Galapagos Marine Reserve (133,000 km²) are both IUCN Category IV areas and are amongst the top twenty largest protected areas on earth (Chape *et al.*, 2008). Of interest to note is that many of the largest MPAs, such as the Great Barrier Reef, the Wadden Sea, the Florida Keys, the Galapagos Islands and the North-western Hawaiian Islands coral reef eco-system reserve (Papahānaumokuākea), are also designated as PSSAs by the IMO.

²² Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas

Invariably MPAs are coastal in nature, including inland waters, and fall within a country's territorial seas, as proscribed by the United Nations Convention of the Law of the Sea (LOSC) 1982 Article 4, therefore do not normally extend beyond 12 nautical miles of a country's baseline²³. Within the territorial sea States have sovereignty to the air space, water, seabed and subsoil and as such have the right to protect the area from threats under their own national law. Furthermore this protection can be extended to include the contiguous zone (extending to 24nm) under Article 24 of LOSC to 'exercise the control necessary to prevent *inter alia* the infringement of sanitary regulations within its territorial seas'.

The IUCN Commission on National Parks and Protected Areas began promoting the establishment and management of a global system of MPAs in 1986 and the World Summit for Sustainable Development in 2002 called for: 'The establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012' Within the IUCN MPA (2012) guidelines, and in line with the desire to create a global network of MPAs, an MPA may be designated in offshore waters and beyond national jurisdiction (beyond the 200nm Exclusive Economic Zone), effectively on the High Seas. However in order to be designated it must have 'boundaries that can be mapped, be recognised by legal or other effective means and have distinct and unambiguous management aims that can be assigned to a particular protected category' (IUCN, 2012, p15).

3.9.1 Management of MPAs

In 2000 the IUCN developed a framework for evaluating the effectiveness of Marine Protected Areas. Essentially providing a tool with which to assess whether current and existing management plans for MPAs are appropriate and to identify how management could be improved through the development of appropriate evaluation and monitoring systems (Hocking, 2000). Within the new guidelines for IUCN MPAs additional guidance is given with respect to management, of interest to note is the adoption of the Core and Buffer zone approach for Category Ia, which aligns closely with the biosphere zonation of the MAB programme. (See Appendix J for IUCN MPA categories)

²³ Baselines define the line from which all claims to maritime jurisdiction and boundaries are measured, they also define the outer limit of States internal waters. LOSC defines a normal baseline (where there are no special geographic circumstances) as being the low water line along a States mainland and island coasts detailed in Articles 5 and 13 of LOSC. If a coastline is deeply indented or there are islands in the immediate vicinity that fringe the coastline a 'straight' baseline may be used as proscribed in Articles 7 and 10 of LOSC.

3.10 Summary

Having reviewed a few of the most relevant agreements and Conventions relating to environmental protection, it is evident that a commonality exists amongst them. This being the need for adopting a sustainable approach, the need to monitor and assess an area and the need for management plans to be implemented. Furthermore, many rely on and utilise multi-lateral environmental agreements in order to ensure that there is limited overlap of effort and that a more 'joined up' approach to management of an area is adopted. This is of particular importance where there are a variety of stakeholders, all with a vested, but different, interest in the area and also differing bio-diversity and eco-systems to manage. A further point to note is the continual review of not only the areas being protected but also the guidelines and advice offered by the various organisations, this being essential in order to address changes in attitude, science and knowledge.

CHAPTER 4

ENVIRONMENTAL MONITORING AND ASSESSMENT

4.0 Introduction

A commonality of many international, regional and national agreements and conventions relating to protection of the environment have is that at their core there is a need to include, from their inception, an appropriate management plan. In order for a management plan to be implemented there is a corresponding need to be able to monitor and assess an area. This chapter will consider the role of assessment and monitoring in order to identify relevance, current approaches and importance of the processes with regard to effective environmental management.

4.1 The role of environmental Monitoring and Assessment

‘...there is no escaping ecological science and monitoring as the primary components for both protected area selection and their future management.’ (Carelton Ray, 1999, p. 612)

A key requirement to the success of any form of environmental protection is the ability to monitor and assess. Whilst common themes and elements exist between both assessment and monitoring, they are clearly differentiated. Monitoring has a temporal element that enables the identification of change through trends over an extended period; assessment can determine if change has occurred within the environment at a given point in time (Russek-Cohen & Christman, 2004). However they should be treated as mutually applicable; without an initial assessment that clearly identifies the current state of the environment and appropriate ecological indicators to be utilised within a monitoring programme, there exists no baseline to work from. It also follows logically that *‘monitoring is most beneficial when it results in more effective management decisions - decisions that protect or rehabilitate the marine environment, its living resources and resources that society considers important.’* (Marine Board, 1990, p. 19). Furthermore, the use of long-term monitoring enables the true state of the environment to be evaluated. In addition, careful selection of indicators that align with management goals will greatly enhance the ability to successfully manage an area.

4.2 Approaches

The marine environment is highly dynamic and generally exists in a state of flux. There are complex interactions within ecosystem processes and anthropogenic influences on

the environment. Historically monitoring of the marine environment has been as a result of national and international conventions and directives²⁴ that encompassed a large variety of parameters, but which addressed very specific requirements, such as the protection of a specific species (Rogers & Greenway, 2005). At the time, collection of baseline data and monitoring was generally based on informal arrangements between various interested parties and programmes such as the United Nations Environmental Programme (UNEP), the International Oceanographic Commission (IOC) and the IMO's Marine Environmental Protection Committee (MEPC) (Cote, 1992).

Whilst monitoring and measuring levels of nutrient discharge into the marine environment, levels of fish stocks, cetacean numbers or quantities of garbage on beaches are all important in their own right, do they give a true picture of what is happening within the marine environment, or just a snapshot of its current state? Additionally the dynamics between and complexities of marine policy and governance creates its own issues. Cross sectoral conflicts naturally occur, such as those between fisheries, oil and gas production, shipping, tourism and nature conservation, where each sector has their own agenda based on political, socio-economic, cultural or conservation criteria. This is further exacerbated through lack of an integrated approach to marine governance where policy is developed and implemented at differing levels i.e. much European fisheries policy is formulated at the EU level and implemented at a national level; Shipping policy being set at both an international level and national level; tourism policy being set at national and sub national level (van Tatenhove, 2010). This cross sectoral conflict in turn leads to a fragmented approach to collection and free exchange of data between parties, which should be deemed as an essential requirement when attempting to monitor and assess a dynamic environment with a multitude of cross sectoral stakeholders.

4.2.1 Eco-system Approach

The Ecosystem Approach is defined as:

“...a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.” (CBD, 2000)

²⁴ E.g. London Convention (formerly the London Dumping Convention), Water Framework Directive, Habitats Directive, Bonn Convention

Over recent years there has been a substantive change in approach driven by commitments to the principles of the World Summit on Sustainable Development (WSSD). Which has led to the development and implementation of the more holistic and inclusive 'Ecosystem Approach' as defined above. Carleton-Ray (1999) highlights the value of this type of approach and the consequences of failure to base management on appropriate information that accounts for the multitude of inputs and trans-boundary elements within the marine environment:

'...it should be clear that absent scientific information on the structure and function of large marine ecosystems, management will be forced to be based mainly on socio-economic factors and value choice, and will operate in a vacuum, thus doomed to failure.' (Carleton-Ray, 1999, p. 613)

The connection between understanding of eco-systems and development of management regimes is not new, but uptake of the concept has been slow. However, it is now accepted that in order to meet the requirements of the CBD, the application of an ecosystem approach to sustainable development is required (Rogers *et al.*, 2007). However it can be argued that the use of this approach by itself may not provide the complete solution with respect to protection of the marine environment as there is also a necessity to account for the needs and views of various stakeholders, whilst at the same time understanding and accounting for the multitude of interactions and the many strata of governance that exist within the marine environment. By its very nature the ecosystem approach is generally orientated to a specific place or area and concentrates on impacts that affect the ecosystem in question. Whilst this is a great improvement on specific management to protect species or sectoral issues it is still somewhat limited.

4.3 Monitoring and Management

Traditional approaches to monitoring of the marine environment invariably concentrated on collection of data that measured a particular indicator, which in turn would be used to measure and evaluate performance against specific targets such as those set by national or international policy; in other words to demonstrate compliance (Hardman-Mountford, *et al.*, 2005). The limitations of this approach are self-evident; whilst over time they may well indicate trends, they do not necessarily give an understanding of how or why changes have taken place. These shortfalls can be addressed to a degree by the use of 'state indicators', which consist of a series of indicators that when analysed in conjunction with each other can give a fuller picture of

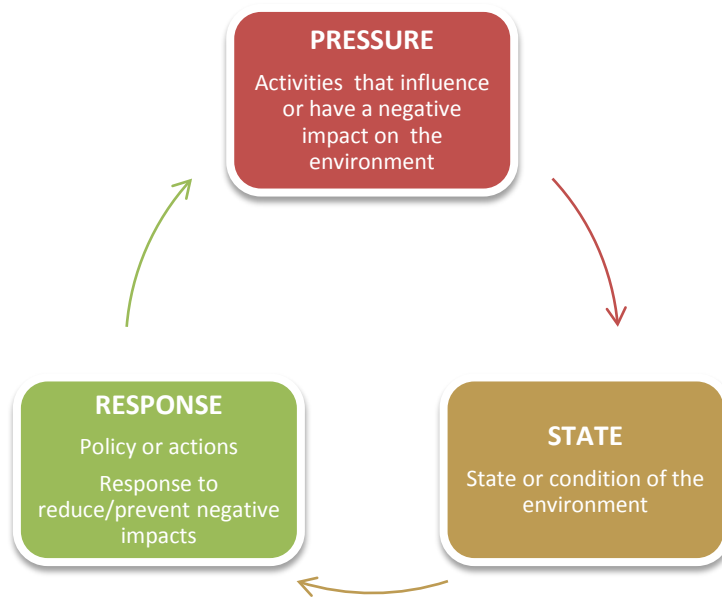
the current state of the marine environment. Through the identification, appropriate selection and measurement of biological or physical indicators for the current state of a particular ecosystem, management plans can be developed and put in place in order to achieve the desired state (Rogers & Greenway, 2005). One short coming of this approach lies in the fact that should changes occur, the actual reason why may remain unclear (Hardman-Mountford, *et al.*, 2005). Research demonstrates that in some instances the failure to recognise which elements of the management plan have been responsible for any changes in state, can be responsible for false hope or hide underlying issues, (*ibid*) which may lead to a somewhat *laissez faire* attitude to future management of the area. Understanding of the reasons for change of state should be seen as key to the success of any protective mechanism. Therefore the need exists to identify and understand the causal effects of change, in order to take action and to develop long-term strategies and objectives. This implicitly requires that both spatial and temporal elements are included within any monitoring and management programme.

The need to account for variability's within and between marine ecosystems and to incorporate and account for issues relating to time, space and scale are key to the development of appropriate and effective assessment, monitoring and management plans for the marine environment. The use of an ecosystem approach that incorporates adaptive management and a more comprehensive and holistic approach to monitoring could address some of the issues identified. However, in order to understand why change is occurring there is a need to account for external influences that impact on the environment, a move away from purely scientific data collection. One such approach that can help achieve this is through the use of the pressure, state, response (PSR) framework.

4.3.1 Pressure, State, Response framework

The PSR framework works on the principle that human activities cause pressure on the environment, which in turn can change the state of the environment and in order to deal with these changes society responds to them. This response is mainly achieved through policies or actions to reduce the pressures and hence the environmental damage caused by them. Key to the success of the use of the PSR framework is that the chosen indicators are not random, but are carefully identified from a clear rationale; this also makes the framework highly adaptive to any given area or set of conditions.

Figure 3. Relationship between Pressure, State & Response .Adapted from (Defra, 2009)



4.4 The role of Marine Spatial Planning

Traditionally marine space has been managed on a sector by sector basis, with clear delineation of management and policy development between various activities such as fisheries, shipping, aggregate extraction, tourism, oil and gas exploitation etc. This sectoral approach can lead to misunderstanding and poor management, particularly with respect to areas where unrelated activities impact on each other. Consequences of a sectoral approach can be identified as:

- A spatial and temporal overlap of human activities and their objectives, causing conflicts (user–user and user–environment conflicts) in the coastal and marine environment.
- A lack of connection between the various authorities responsible for individual activities or the protection and management of the environment as a whole.
- A lack of connection between offshore activities and resource use and onshore communities which are dependent on them.
- A lack of conservation of biologically and ecologically sensitive marine areas.
- A lack of investment certainty for marine developers and users of ocean resources

(Douvere, 2008, p. 262)

The identification and realisation of the positive benefits of removing conflict across sectors in order to facilitate effective management is not new with respect to the marine environment. The case for integration of marine policy was put forward by Underdahl (1980) and the development of practice and application was furthered by Thai-Eng (1993) and Cicin-Sain (1993) with respect to management of the coastal zone (Table 3), a multifaceted area with many demands and uses that are often in direct conflict with each other.

Table 3. Key principles of Coastal Zone Management. (Based on Cicin-Sain, 1993 & Thai-Eng, 1993)

INTEGRATION	Conflict reduction, prevention and solving Optimal mix of uses Harmonization of management effort/process Public support Based on sound information/data
STRATEGY	Long term view Scaled plans (integrated) Implementation strategy Political/administration factors/forces Human/physical interactions Coastal Zone (perceived/defined)
FLEXIBILITY	Pre-emptive and responsive Adaptable to change (both use and environment)

Within coastal zone management (CZM) the ability to identify, ameliorate, reduce and resolve potential areas of conflict across the various stakeholders with a vested interest in the coastal zone is achieved through an approach to management that involves both horizontal and vertical integration of all sectors. This integrated approach is now being advocated in the form of Marine Spatial Planning which can be defined as:

‘..a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that are usually specified through a political process’. (Ehler & Douvere, 2009)

The ability to identify spatial and temporal areas of biological and/or ecological sensitivity within a marine area and to recognise potentially conflicting uses enables appropriate management and monitoring regimes to be implemented. The elements of monitoring, reporting and evaluation are critical functions of MSP (Ehler, 2008), allowing for an adaptive approach that responds to changing conditions (Table 4).

Table 4. Characteristics of Effective Marine Spatial Planning (Ehler & Douvère, 2009, p. 18)

Ecosystem-based	Balancing ecological, economic, and social goals and objectives toward sustainable development
Integrated	Across sectors and agencies, and among levels of government
Place-based or area based	
Adaptive	Capable of learning from experience
Strategic and anticipatory	Focused on the long-term
Participatory	Stakeholders actively involved in the process

Marine spatial planning has come to the forefront over the past few years and will become even more vital in the future due to the increasing competition between industries for use of the sea. MSP is designed to “help(s) public authorities and stakeholders to coordinate their action and optimises the use of marine space to benefit economic development and the marine environment” (Commission of the European Communities, 2008, p2). Additionally, MSP creates a framework for evaluating and assessing human activities in order to manage any impact that they have on the marine environment. In order to achieve this there is a need to advocate and develop co-operation across states and between stakeholders in order to:

“develop a holistic approach to the management of maritime activities in line with ecosystem requirements” (Commission of the European Communities, 2008, p3)

By its definition and design MSP includes the need to ensure that this extends to the many conventions and protocols that are in place to protect the marine environment, in order to ensure that they function in harmony and do not conflict or replicate effort.

4.5 Summary

The benefits of assessment and monitoring allow for adaptive management and the ability to respond to changes at the earliest opportunity. Whilst the eco-system approach to management has many benefits, short comings relate to the fact that whilst holistic with respect to the environment and biodiversity, its application to date fails to fully account for the multitude of stakeholders and the many levels of governance within marine areas. The development of MSP, which follows the more integrated approaches of coastal zone management, enables horizontal and vertical integration as well as enabling cross sectoral conflicts to be addressed. This more adaptive approach clearly addresses many of the issues, however management plans developed in line with MSP,

still require the use of appropriate monitoring and assessment to ensure effective protection for the area.

CHAPTER 5

METHODOLOGY

5.0 Methodological approach

Research that investigates protection of the marine environment crosses many boundaries and disciplines. Whilst some areas can clearly be classified as falling within the parameters of pure science, law or social science, there are many areas that encompass several of these disciplines. As such the methodological approach to this research needed to take account of and adapt to these varied disciplines. Research into marine environmental protection could be undertaken through a positivistic approach. However, this approach assumes that there exists an object truth which can be shown through scientific methods and where the hypothesis is tested by measuring relationship variables systematically and statistically (Cassell & Symon, 1994). As the focus of this research was to investigate the effectiveness of marine environmental protection from shipping and maritime activities, factors that fall outside of purely scientific data needed to be considered and incorporated within the study. For this reason a post positivistic approach was utilised. Within post positivism the researcher can interpret results within the context of individual data sets, both spatial and temporal, in order to make connections whilst at the same time accounting for differences (Wisker, 2008). The flexibility to interpret results within the context of a given area is imperative within this research project as within each PSSA designation there are many differences including date of designation, geographical location, size of area, perceived levels of vulnerability to shipping, environmental sensitivity, level of active engagement by States with regard to enforcement, stakeholder knowledge and stakeholder education.

The research methodology at the early stages was predominately inductive, allowing for data to be collected and a theory developed as a result of the data analysis (Saunders, *et al.*, 2007). The use of this approach allowed for key areas such as vulnerability and sensitivity mapping in conjunction with stakeholder awareness/responsibility and the role of local, national and international governance to be examined in order to fulfil the aim of measuring perceived effectiveness of a designation. In an environment that is fluid and dynamic and where the effect of inputs that fall outside of a designated protective area can have catastrophic consequences which cannot be controlled through the designation alone, the issue of effectiveness requires rigorous and systematic testing in order to identify those elements that fall within and outside the parameters of the process.

5.1 Literature review

Literature reviews are the basis of all preliminary research and form the foundation of any research project. Primary literature, sometimes referred to as ‘grey’, includes reports, theses, government publications and conference reports that contain a high level of detail (Saunders *et al.*, 2007). The majority of literature reviewed for this research was in the form of primary literature; however rather than being paper based, availability of many reports was via the internet, which enabled many of the earliest reports (such as those relating to the IMO) to be accessed through ‘electronic archives’.

The initial stage of the research (objective 1 & 2) comprised an extended literature review in order to inform the research process and to assist with the development of an appropriate mechanism that could be utilised within the case of study of the Wadden Sea. Firstly the literature reviewed addressed the development of the IMO and their response to change with regard to protection of the marine environment and how this related to the initial concept behind the development of PSSAs. Secondly literature pertaining to other environmental protective mechanisms was reviewed.

Evaluation of reports from the IMO and the Marine Environmental Protection Committee (MEPC) was integral to understanding the concept behind PSSA designations, the problems associated with development of the guidelines for designation and for identifying potential shortfalls within the existing guidelines. The findings were reviewed in conjunction with scholarly articles and books relating to PSSAs in order to ensure that a systematic appraisal was undertaken. It should be pointed out that a limited amount of literature pertaining to PSSAs exists, however the focus of much of this relates to legal issues associated with the designation as opposed to effectiveness of the designations as an environmental protective mechanism. For this reason there was a need to review literature that pertained to environmental protection that falls outside the remit of the IMO.

In order to understand the processes and issues faced when implementing environmental protection a review of some of the key protection mechanisms was undertaken. The process started with the identification of major environmental conventions, treaties and agreements in order to place them in chronological order and to identify those that had a marine element (Appendix A). From this list, those that were deemed to be exemplars or which had a major marine element were reviewed in chronological order in order to

identify how these protective mechanisms developed and how they are designated and managed, particularly with respect to the role of monitoring and assessment.

5.2 Case study

Case studies allow for an in depth exploration of a situation, involving ‘....an empirical investigation of a particular contemporary phenomenon in its real life context using multiple sources of evidence.’ (Robson, 1993:52 cited in Wisker, 2008). Through case studies both temporal and spatial issues can be examined and issues pertaining to availability of and collection of both qualitative and quantitative data can be taken into account.

5.2.1. The Wadden Sea Case study

The opportunity to meet objectives 3 and 4 of this research - to develop a methodology to evaluate the effectiveness of PSSAs and the evaluation of an existing PSSA, was undertaken through a research project on behalf of the Common Waddensee Secretariat (CWSS). The following section describes the methodology utilised for the evaluation of the Wadden Sea PSSA. The process undertaken was informed by the terms of reference (TOR) as set by the CWSS:

“Assess the effectiveness of the Wadden Sea PSSA, and whether the designation has contributed to provide specific protection of the Wadden Sea from impacts through shipping. Furthermore, whether the current PSSA designation needs to be enhanced in terms of the area and associated matters or with regard to additional measures”.

The TOR also required the identification of shipping related incidents since designation of the PSSA in 2002 and an evaluation of awareness of the designation amongst mariners and other sectors, both of which are pertinent with regards to identification of the ‘effectiveness’ of the designation. Within this research the final element of the TOR, relating to enhancement of the PSSA with regard to additional measures, is omitted as it does not relate directly to the research aim of establishing the ‘effectiveness of a PSSA as a protective mechanism from international shipping’.

5.2.2. Development of the evaluation process

To evaluate the Wadden Sea PSSA a methodology needed to be developed which would allow a systematic and rigorous evaluation to take place, thereby enabling assessment of

how ‘effective’ the designation was. To achieve this, the evaluation was broken down into three tasks. The first task was a scoping exercise which comprised two elements, a desk study of relevant documents and legislation pertaining to PSSAs and the marine environment, which was undertaken in conjunction with the literature review for objective 1 of this research, the findings of which were supplemented by the opinion and views of ‘experts’ on the marine environment and PSSAs. The second task pertained to the development of an evaluative framework which was then utilised in order to undertake a risk assessment, the process being informed by the findings of objective 2. The final task entailed a review of the findings of the risk assessment in order to make a judgement on the effectiveness of the PSSA.

Task 1: Part A - Desk study to review the status of PSSAs at IMO and identify changes in legislation and policy relating to shipping

Part B - Questionnaire to obtain opinion and views of ‘experts’ with regard to PSSAs and their effectiveness

Task 2: Part A - Develop an evaluative framework

Part B - Undertake a risk assessment using the evaluative framework

Task 3: Review findings of risk assessment and make a judgement of effectiveness of the PSSA

5.2.3. Desk study (Task 1 – Part A)

A desk study was undertaken which comprised a literature review of relevant documentation and studies that had been published since the initial designation of the Wadden Sea PSSA. The review also identified any changes to the International Maritime Organisation (IMO) regulations governing both PSSAs and shipping, to identify elements that may have had an impact on the evaluation. Changes to and new European Union (EU) legislation pertaining to shipping and the marine environment were also reviewed.

5.2.4. Expert Group (Task 1 – Part B)

In order to further understand issues associated with PSSAs and to further verify the findings of the literature reviewed for objectives 1 and 2, a group of experts (Table 5) with an interest in PSSAs and the issues associated with their designation and management of the marine environment were identified and invited to participate in the evaluation of the Wadden Sea. The experts were asked to contribute by responding to a

questionnaire survey aimed at identifying and reviewing the key issues pertaining to PSSA development, effectiveness and legislation. The primary data collected was then utilised to inform the research and the development of the indicator suite for the evaluative framework.

Table 5. List of participating experts

Expert	Area of Expertise
Kristina Gjerde	High Seas Policy Advisor - IUCN. Development of amendments of PSSA guidelines for IMO
Sjon Huisman	Advisor to Response Organisation for the Ministry of Transport, Public Works and Water Management (NL). Bonn Agreement, EU/EMSA, Maritime emergency response
Lindy Johnson	Attorney and Advisor to Office for General Council of International Law - NOAA. Development of amendments of IMO guidelines. Florida Keys and Papahānaumokuākea PSSAs. Advisor on proposal for Galapagos designation
Dr Anita Makinen	Head of Marine Programme - WWF, Finland. Baltic Sea PSSA
Marc Patry	Programme specialist, UNESCO. World Heritage Sites
Dr Sian Prior	Marine science and policy consultant. Sabana Camaguey PSSA, Western European PSSA
Dr Julian Roberts	Advisor on Ocean Governance - Commonwealth Secretariat. PhD on Application and development of PSSA concept
Dr Hans Ulrich Rosner	Head - Wadden Sea Office – WWF-Germany Wadden Sea PSSA
Dr Simon Walmsley	Head - WWF International - Marine programme. NGO status at IMO (MEPC)

5.2.4.1. Questionnaire

Eight questions were developed in order for the experts to identify key issues and perceived areas of concern with PSSAs (Appendix B). These being informed by the literature reviewed and included the function of PSSAs as protective mechanisms, appropriateness of existing designations, stakeholder awareness of designations and how to measure the effectiveness of a PSSA. Open questions were used so that the respondents could be as expansive as they wished; they were also encouraged to identify any literature that supported their views. From the responses received, key ideas, concerns and recurring themes were identified;

5.2.5. Develop and evaluative framework (Task 2- Part A)

To measure the effectiveness of the Wadden Sea PSSA it was necessary to develop an evaluative framework that could be utilised to identify and highlight key issues that are associated with the marine environment, shipping and PSSAs, in order to assess their spatial and temporal impacts on the area. The framework was developed from the views

expressed by the experts and was also based on a review of data that was, or could reasonably be expected to be available and accessible. This included *inter alia* shipping movements and cargo carried; maritime accidents and collisions; incidents of pollution (accidental and intentional); operational discharges; physical damage to marine biodiversity. Other data reviewed included the physical, chemical and biological characteristics of the area in order to reflect characteristics such as environmental quality and spatial environmental sensitivity; along with maritime resource uses of the area. Data pertaining to shipping accidents and incidents, that was available, was provided by the various marine administrations of the Wadden Sea countries, additional data required came from other existing sources²⁵ and risk analyses²⁶. Within the framework there was a need to account for environmental quality, environmental pressures and changes in state over time, whilst also accounting for any changes that could have been deemed as societal response, this was achieved through the use of indicators.

5.2.5.1. Indicators and the Pressure, State, Response framework

Environmental quality can be ascertained through the selection of indicators²⁷ (based on relevant information and available data) that can be placed within the framework in order to assist in simplifying the complex reality of interpreting environmental measurements (Sheets & Weterigs, 1999). One of the earliest frameworks to utilise indicators was the Stress Response Environmental Statistical System (STRESS) developed in Canada in 1979, where the focus was on how an ecosystem responded to the pressures placed on it. This framework was modified by the OECD during the 1990's to the Pressure, State, Response framework (PSR), where the response element was amended to link directly to societal response (Stanners, *et al.*, 2007). Within the PSR framework the selection of indicators can be tailored in order to measure a particular element, phenomena or situation. (Table 6).

The use of the PSR framework which enables the tailoring of indicators to a particular situation was deemed appropriate for this research, due to its adaptability and relative simplicity. While there are some generic indicators that can be utilised within evaluations of any marine area or PSSAs, to ensure robustness of an evaluation and to

²⁵ E.g. Trilateral Monitoring and Assessment Programme Quality Status Reports 1993 - 2009

²⁶ E.g. GAUSS (2004) Marine safety & pollution in the Wadden Sea; COWI (2007), Risk analysis of oil spills in Danish waters.

²⁷ Indicators provide information about phenomena that can be regarded as typical for and/or are critical to environmental quality (Sheets & Weterigs, 1999).

enable the framework to be adapted and used elsewhere there is also a requirement to be able to include indicators that are site specific.

Table 6. Types of indicators

Type	Indicators	Measures
A	Descriptive 'What is happening?'	Trends
B	Performance 'Are we reaching targets?'	The distance between current situation to desired situation
C	Efficiency 'Is there improvement?'	The relationship between drivers and pressure in order to look for change +ve/-ve
D	Policy effectiveness 'Are measures working?'	Identifies actual change of environmental variables in response to policy efforts
E	Welfare 'Are we better off?'	Identifies the balance between economic, social and environmental development

(Based on Stanners *et al.* 2007)

The Driving Force, State, Response (DSR) framework, which evolved from the PSR framework, was not utilised as this is generally used to account for sustainable development issues (FAO, 2012). The Driving Force, Pressure, State, Impact, Response (DPSIR) framework adopted by both the European Environmental Agency (EEA) and by the Department of the Environment, Farming and Rural Affairs (Defra) in the UK was also considered as it is argued that without understanding the driving forces for change in the environment, it is difficult or impossible to identify or take remedial action (Kristensen, 2004, Hardman-Mountford *et al.*, 2005). If considering the context of evaluation of a PSSA the driving force indicators would relate to the economic value of shipping to the area or the reliance of industry on shipping in the area. However, as these elements have limited value with regard to assessing effectiveness of a designation as a protective mechanism, the DPSIR framework was discounted and the more straight-forward PSR framework was retained. Should a more in depth investigation be required after an initial evaluation of a PSSA, by utilising the PSR framework initially, the process could be easily enhanced through the introduction of the additional indicator groups, driving force and impact, used in the DPSIR framework, thereby enabling remedial action to be identified.

5.2.5.2. Indicator selection

For the case study a general indicator suite of marine environmental pressures, measures and actions was developed, based on the available data and expert opinion. A key area

of difficulty with the selection of these indicators related to the ability to extract a specific shipping signal from some of the data, this being a key requirement for assessing a protection mechanism aimed at the shipping industry.

Pressure indicators were identified, based on maritime activities which may affect a PSSA such as shipping volumes by type, shipping incidents, low impact collisions, high impact collisions, reported oil spills and *in situ* wind farms, all of which may cause pressure on the environment and lead to change in its state. State indicators were identified, based on the state of the environment, including environmental quality measures such as winter nitrate concentration, winter phosphate concentration, TBT concentration, non-indigenous species by number, oiled birds, marine litter etc. Response indicators were actions taken to respond to the change in state caused by the pressure. Those identified included Associated Protective Measure²⁸ (APM) development, communication to mariners, local agreements, co-ordination between States, oil spill response plans, and stakeholder education/awareness (Appendix D).

Each of the indicators identified was rated using a Likert scale which enabled un-dimensional scaling (Trochim, 2006), using declarative sentences, *“followed by response options that indicate varying degrees of agreement with or endorsement of the statement”* (DeVellis, 2003, p. 79). Two general declarative statements were used:

- The strength of link to maritime activity
- The potential risk to marine environment

Each was then ranked on a scale of 1 to 5, (5 being of high relevance and 1 being of low relevance), thereby giving each indicator a ‘general’ relevance value. To enable a more specific focus on the Wadden Sea PSSA a third declarative statement was added, in which the indicators were additionally ranked to give an ‘area specific’ value using the statement:

- The strength of specific link to the Wadden Sea PSSA.

The ‘area specific’ value was then multiplied by the ‘general relevance’ value to establish the strength of each indicator with respect to the Wadden Sea PSSA. Indicators with a value of 40 or above were seen as high relevance, moderate relevance

²⁸ *Associated Protective Measure* are actions that have been approved or adopted or by the IMO. These include: Designation of MARPOL Special Areas (Annex I, II, V), designation of SECAs (Annex VI), Ships routing and reporting, Areas to be avoided, or any other measure that has a legal basis and falls within the remit of the IMO.

was identified by values of 35-40, any indicator with a value of fewer than 34 was seen as low relevance. In order to ensure that all appropriate indicators were included within the evaluative framework and the correct level of relevance with respect to the Wadden Sea was attached; members of the project Steering Committee from the CWSS were invited to rank the indicators themselves using the same method. They were also invited to suggest any additional indicators that they thought were relevant or missing from the indicator suite. The ranked indicator suite is contained in Appendix E. Identification of available data and sources for the indicator suite is contained in Appendix F. The final indicators selected are identified in section 7.2 (Table 7 p74).

5.2.5.3. Stakeholder awareness

Stakeholder awareness is a key issue within the PSSA concept, as all the stakeholders need to understand and support the concept in order for it to be effective. Stakeholders are all those with a vested interest in the area and includes not only mariners and those whose livelihoods depend on the sea, but also others such as tourism agencies, national protection agencies and conservation NGOs.

In order to assess the level of stakeholder awareness a simple questionnaire was designed to identify the level of awareness of PSSAs and their purpose amongst key stakeholders. The questionnaire consisted of 4 questions, in plain language in order to avoid confusion where translation was required. The questions were promulgated to deck officers studying at Warsash Maritime Academy in Southampton and also to officers serving on vessels via email. Key stakeholders in the Netherlands, Germany and Denmark, were approached through contacts within the CWSS. The questions asked were:

1. Have you heard of a Particularly Sensitive Sea Area (PSSA)?

Yes No

If yes, what do you think a PSSA is for?

2. How did you hear about PSSAs?

3. Could you identify the location of any PSSAs?

4. How is a PSSA marked on a nautical chart?

A total of 88 responses were received. Whilst simplistic in nature the questions enabled a basic overview of awareness to be obtained.

5.2.6. Use of Geographic Information System (Task 3)

The use of GIS for environmental assessment has developed rapidly over the past few years and is now commonly utilised as a decision making tool that allows for spatial and temporal changes to be accounted for and (in theory) well informed planning and management decisions to be considered.

The final element of the evaluative framework process was to collate time series data on indicators that related to shipping accidents and incidents which was mapped using GIS, both within and outside the PSSA. Information obtained from the desk study and also indicators identified from the evaluative framework were utilised to undertake a targeted spatial analysis of the area. Basic hydrographic data, shipping lanes and data pertaining to high relevance indicators was overlaid on a map of the Wadden Sea PSSA²⁹. Additional layers were then added which included location of emergency response vessels, offshore installations, planned offshore developments and shipping accidents (where available). This enabled spatial and temporal changes in risk to be highlighted and the significance of current risk to be mapped. The results were also utilised to identify future risk reduction measures.

5.2.7. Limitations

A major limitation with this research project was the use of only one case study. PSSAs exist in a variety of geographic areas and there exist both temporal and spatial differences. Additionally each PSSA will have demonstrated a different vulnerability to international shipping activities. As such there may be underlying issues with the use of the methodology for evaluation as developed for the Wadden Sea case study. However it is suggested that the use and development of the pressure, state, response approach and identification of indicators with a specific shipping signal should enable some of the issues to be overcome. A further limitation relates to the availability of accurate data in a useable form. The quality and quantity of data is very much in the hands of the Member State or States who are responsible for any PSSA designation and the readiness to share data could be problematic. This becomes even more of an issue when there are multiple States involved, who may not be collecting the same data, using the same criteria for collecting data or using the same method of recording data.

²⁹ A similar exercise was undertaken for the 2001 PSSA feasibility study completed by Southampton Institute for the CWSS

The issue of measuring awareness amongst stakeholders could only provide a 'snapshot' and possibly does not offer a true appraisal; this being due to time constraints and sample size. A more accurate appraisal could only be achieved by undertaking a far more extensive survey with a larger sample group.

Whilst the use of GIS is beneficial when looking to future measures to protect an area, as a means of measuring effectiveness it is limited by the quality of data collected and whether a time series can be incorporated from the period before an area was designated to the present time.

CHAPTER 6

CASE STUDY: THE WADDEN SEA PSSA

6.0 Introduction

This section of the thesis presents a case study of the Wadden Sea PSSA and includes the research and findings with respect to the effectiveness of the designation as a protective mechanism from international shipping. It is based on an evaluation project³⁰ undertaken on behalf of the Common Wadden Sea Secretariat; however it does not include those elements of the project that related to the identification of additional protective measures. Furthermore all findings relate to the period covered by the evaluation project. The following three chapters relate to the tasks identified in chapter 2, (2.2.2). They comprise of a brief overview of the Wadden Sea and a review of policy and legislation relating to shipping and the PSSA since its designation; empirical data utilised to measure the status of the PSSA; followed by an evaluation and discussion of the findings in the wider context.

6.1 The Wadden Sea area

The Wadden Sea is a highly dynamic coastal eco-system of coastal dunes, river mouths, salt marshes, tidal flats and barrier islands, lying adjacent to the North Sea and extending over an area of approximately 9,500 km². The coastline extends from Den Helder in the Netherlands northwards to Blavandshuk in Denmark (Figure 4). Jurisdiction of the Wadden Sea with regard to responsibilities of sovereign States as proscribed by UNCLOS, is tri-lateral, 30% belonging to the Netherlands, 60% to Germany and 10% to Denmark (Johnson *et al*, 2001), with the majority of the coastline being situated within Germany.

Environmental protection of the area on a tri-lateral basis dates back to 1978 when the first steps towards the creation of a Joint Declaration on the Protection of the Wadden Sea were taken, which was ratified in December 1982. This Declaration iterated the trilateral States desire to protect the natural environment and their legal obligations with regard to the Convention on Wetlands of International Importance especially as Wildfowl Habitats (Ramsar Convention), Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and relevant EEC Directives

³⁰ Evaluation of the Wadden Sea (Butt, Gallagher, Thatcher, Vigar, & Wright, 2010)

including the Council Directive on the conservation of Wild Birds (Wild Birds Directive) (Wadden Sea, 1982).

Over the past 30 years, protection of the area has remained of paramount importance and has seen the designation of Special Protection Areas (SPAs), Special Areas of Conservation (SACs), UNESCO Biosphere Reserve status (Germany and Netherlands) and most recently the inscription of the Wadden Sea on the World Heritage List in 2009, encompassing the German and Netherlands sectors of the Wadden Sea. In January 2013 Denmark submitted a nomination for their area of the Wadden Sea to be included as an extension to the existing World Heritage Site³¹ (Wadden Sea, 2013).

In October 2002 a discrete area of the Wadden Sea was designated by the IMO as a PSSA (MEPC 48/21), and in common with many of the protective mechanisms in the Wadden Sea, includes sectors belonging to all three States. The Wadden Sea area is subject to high levels of shipping traffic due to the location of major shipping routes and several major north European ports; however the area covered by the PSSA excludes all of the major shipping routes and entrances to the ports (Figure 5).

The Wadden Sea was designated as a PSSA following recommendations resulting from a feasibility study undertaken by Southampton Institute (now Southampton Solent University). The Wadden Sea and adjacent North Sea area are subject to extensive protective measures, comprising of both national and international regulations, the aim of which are to reduce risks directly related to shipping. Such measures include *inter alia* MARPOL Special Areas, routing measures, ship reporting etc. These measures are not associated with the PSSA; no new or additional measures were included in the designation.

³¹ The result of the Danish submission is expected in mid 2014

Figure 4. General extent of the Wadden Sea (CWSS, 2012)

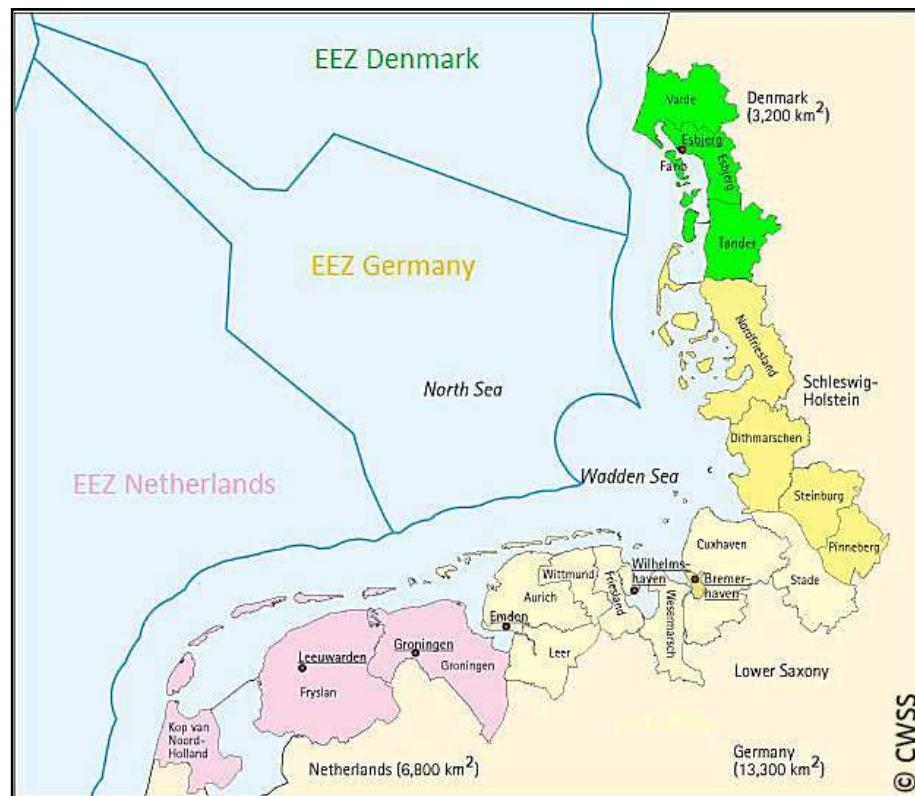
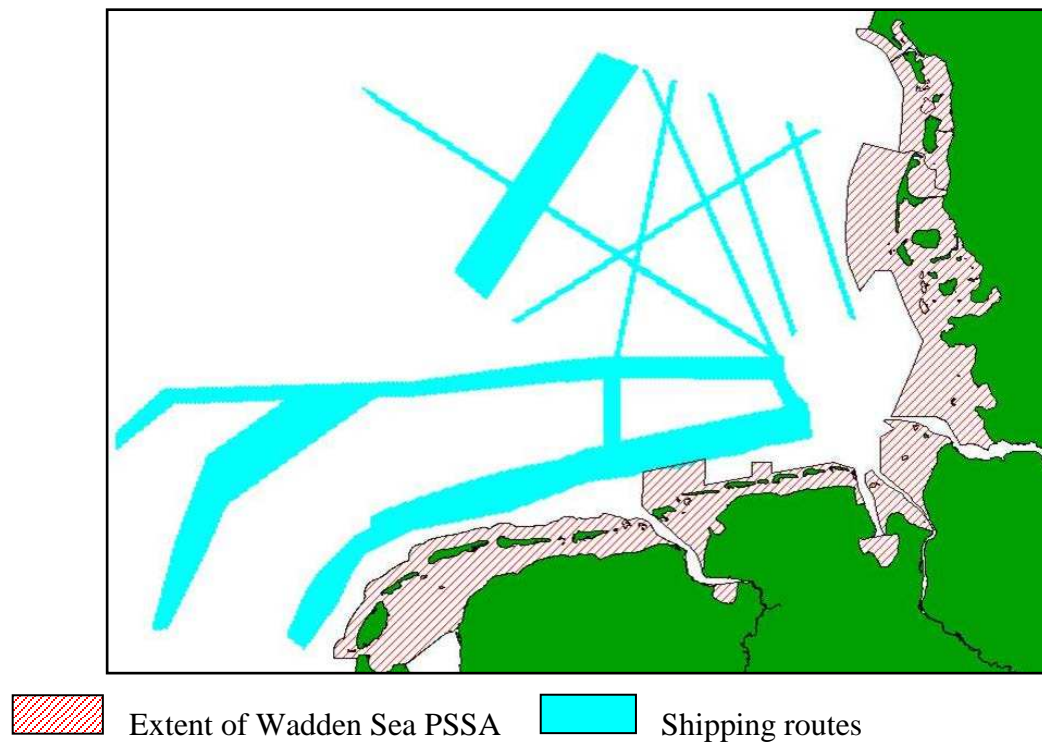


Figure 5. Delineation of the Wadden Sea PSSA and major sea lanes (Butt *et al.* 2010)



6.2 Status of PSSAs at IMO and identification of changes in legislation and policy relating to shipping

Since the designation of the Wadden sea as a Particularly Sensitive Sea Area (PSSA) in 2002 a number of IMO Conventions and Regulations concerning the marine environment, have either entered into force, been adopted or been revised. Additionally new EU policy has also been implemented or has been formulated. The following section identifies and discusses these changes. Furthermore as previously discussed (3.5.4), revised guidelines for the identification and designation of PSSAs were adopted in 2005. These revisions relate to Resolution A.982 (24). As these have already been discussed in chapter 3 (3.5), they will not be included in this section. Changes to policy and current ship safety and security measures in the Wadden Sea area, implemented by the Wadden Sea States are reviewed.

6.2.1 IMO

Three new Conventions relating to shipping and the marine environment entered into force since the PSSA designation in 2002, along with the introduction of a new Annex to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) as well as several amendments to existing annexes.

6.2.2 MARPOL 73/78

MARPOL 73/78 is the major international Convention relating to prevention of pollution from ships into the marine environment, since its adoption it has been continually reviewed and has undergone several amendments. The Convention now includes six Annexes which cover all aspects of pollution (Oil, Noxious Liquid Substances, Harmful Substances Carried by Sea in Package Form, Sewage, Garbage, and Air Pollution). Since 2002 a number of amendments and revisions have been made to the Convention including the adoption of Annex VI Regulations on Prevention of Air Pollution from Ships. These are identified and discussed with regard to their implications for shipping in the Wadden Sea Area in the following section.

6.2.2.1 Annex I – Regulations for Prevention of Pollution by Oil

In 2001 the revised Regulation 13G of Annex I brought forward the phasing out of single hulled tankers³² after pressure from the European Union over the sinking of Erika³³, this was subsequently amended in 2003 and entered into force in 2005. Under the revised Regulations the scrapping of Category 1 tankers (Pre-MARPOL) was brought forward to 2005 from 2007, and Category 2 and 3 tankers³⁴ were brought forward to 2010. Furthermore Port States can deny entry to ports and offshore terminals to single hull tankers which are allowed to operate until their 25th anniversary, however they must inform the IMO of their intention to do so. (Annex I, 2001 amendments para 8b).

In 2004, further revisions included two new Regulations which entered into force in January 2007. Regulation 22 states that ships constructed on or after 1st January 2007 which are 5,000 deadweight tonnes or above shall have a pump-room with a double bottom. Regulation 23 relating to accidental oil outflow performance, stipulates that all vessels delivered on or after 1st January 2010 must be constructed in such a way as to provide adequate protection against oil pollution in the instances of collision or stranding.

6.2.2.2. Annex IV – Prevention of Pollution by Sewage from ships (In force 2003)

In 2004, Annex IV was revised making the regulations more stringent. The Annex applies to all new ships of 400+ gross tons involved in international voyages; existing ships will have 5 years from date of entry into force to comply. Additionally under the revised Annex ships will need to be equipped with one of three sewage treatment systems; a sewage treatment plant; a sewage comminutating and disinfecting system; or a sewage holding tank as the discharge of untreated sewage into the sea will be prohibited within 12nm (territorial sea) of any member State.

6.2.2.3. Annex VI - Prevention of Air Pollution by ships (In force 2005)

In 1997 Annex VI was adopted, however it was not until May 2005 that it entered into force. This Annex set rules for the levels of oxides of sulphur (SOx) and nitrogen (NOx) that can be released from ships exhausts with a global cap on the sulphur content of fuel of 4.5% m/m. The Annex also identifies Sulphur Emission Control Areas

³² Existing Crude oil tankers 20,000+dwt and Product tankers 30,000+ dwt

³³ The Erika sank in December 1999, spilling her cargo of 30,884 tons of heavy oil in the Bay of Biscay

³⁴ Category 1, 2 & 3 tankers are identified by the year they were delivered and entered into service

(SECAs) including the North Sea, English Channel and surrounding coastal waters and the Baltic Sea, where sulphur content of fuel being burnt must not exceed 1.5%, or vessels must be fitted with an exhaust gas cleaning system or other suitable technology to limit SOx emissions.

In 2008 further amendments were added to this Annex which are due to come into force between 2012 and 2020, these reduce the level of SOx emissions further. SOx emissions from ship exhausts had to be further reduced from 4.50% to 3.50% by 2012, progressively being reduced to 0.50% by 2020. A feasibility review of this limit will be completed by 2018 at the latest. Limits for emissions within SECAs will be reduced to 1.0% by 2010 and further reduced to 0.10% by January 2015. NOx emissions for marine engines were also agreed with the most stringent reductions being placed on Tier III engines (those installed on ships constructed after 2016 operating in emission control areas).

6.2.3. The London Convention Protocol 1996 (In force 2006)

In 1996 the London Convention Protocol was adopted bringing the London Dumping Convention (LDC) of 1972 up to date and in line with current issues. The purpose of the 1996 Protocol is similar to that of the LDC, which aimed to protect the marine environment from all sources of pollution. The Protocol entered into force in March 2006³⁵ ten years after it was adopted. The 1996 Protocol is more restrictive than the LDC and applies the precautionary principle with regard to any waste or matter being introduced to the marine environment. Under the Protocol all dumping is prohibited unless explicitly permitted under the reverse list³⁶ which includes dredged material, fish wastes and inert, inorganic geological material. Furthermore the Protocol also bans incineration at sea³⁷ of industrial waste and sewage sludge, with the polluter pays principle also adopted; if a company/person is caught dumping any banned substances they will have to bear the cost. In 2006 amendments were made to the Protocol which entered into force in February 2007 which allows for the storage of carbon dioxide under the seabed. This amendment has created a basis “in international environmental law to regulate carbon capture and storage (CCS) in sub-seabed geological formation” (IMO, 2002c).

³⁵ At the time of the evaluation in 2009 Netherlands were not signatories of the London Dumping Protocol – only the Convention

³⁶ This is a list of acceptable items which can be dumped at sea under the 1996 Protocol (IMO, n.d.)

³⁷ Banned under Article 5 of the 1996 Protocol (IMO, 2002c).

6.2.4. The Protocol on preparedness, response and co-operation to pollution incidents by hazardous and noxious substances 2000 (OPRC-HNS Protocol) (In force 2007)

In June 2007 the OPRC-HNS Protocol entered into force, in order to combat major incidents or threats of marine pollution. The Protocol aims to establish a global framework for international co-operation; as such any State party to the HNS Protocol will be required to establish measure for managing pollution incidents. Furthermore, ships must carry onboard a pollution emergency plan which specifically deals with hazardous and noxious substances in case of an incident.

6.2.5. The International Convention on the Control of Harmful Anti-Fouling Systems on Ships (AFS) (In force 2008)

In 2001, before the designation of the Wadden Sea PSSA, the AFS Convention was adopted which prohibits the use of harmful organotin in anti-fouling paint on ships hulls. The Convention entered into force in 2008. The function of the convention is to remove the introduction of compounds such as tributyl-tin (TBT) into the marine environment, which can have a range of sub-lethal effects on a many species of shellfish.

6.2.6. The Nairobi Convention on Removal of Wrecks (Adopted 2007, not yet in force)

This Convention “will provide the legal basis for States to remove, or have removed, shipwrecks that may have the potential to affect adversely the safety of lives, goods and property at sea, as well as the marine environment” (IMO, 2002d). It will do so by setting international rules for “prompt and effective removal of wrecks located beyond the territorial sea” (IMO, 2002d). Under this Convention the owner will be liable for the financial cost of finding, marking and removal of the wreck.

6.2.7. The International Convention for the Control and Management of Ships Ballast Water and Sediments (Adopted 2004, not yet in force)

This Convention contains technical standards and requirements for the control and management of ships' ballast water and sediments (IMO, 2002e). Ballast water is a necessary stability requirement for most ships. When taken onboard the water may contain species which, without treatment, can survive the ships transit and then be

released in a foreign environment, where they may flourish. When in force this Convention will, “prevent, reduce and ultimately eradicate the transfer of harmful aquatic organisms and pathogens in the ballast water” (IMO, 2002e). Once in force this convention will require all ballast water to be treated. Article 5 of the Convention addresses the need for all ports where ballast tanks are cleaned or repaired to provide Sediment Reception Facilities. The Convention also requires that ships should be surveyed/inspected by Port State Control to ensure that the ship has a valid certificate and keeps an up to date Ballast Water Record Book.

6.2.8. Discussion of IMO policy changes in relation to the Wadden Sea PSSA

Revisions to MARPOL Annex 1 should be seen as having a positive effect on the PSSA, as when fully implemented, no tanker transiting the area will have a single hull, thereby reducing the risk of oil entering the environment as a result of collision or grounding. Additionally all new tankers will be required to meet stricter construction standards. The revisions relating to Ports States denying access to single hulled tankers has been implemented by the port of Wilhelmshaven in Germany, where tankers older than 20 years old may not enter the port (ConocoPhillips, 2007a). This should ensure additional protection to the area as single hulled tankers are generally deemed to have a higher risk of pollution in the event of a collision or grounding.

Enforcement of Annex IV will mean that no untreated sewage will be released into the territorial seas of the Wadden Sea States thereby reducing the level of nutrients entering the system from the shipping. Likewise designation of the North Sea as a SECA under Annex VI, which includes the area delimited by the Wadden Sea PSSA should also reduce harmful emissions being released into the area,

The OPRC-HNS Protocol also has the potential of preventing pollution within the PSSA as the requirement for all vessels to have in place emergency plans for dealing with a pollution incident, should ensure that where possible the vessels themselves will be able to try and deal with an emergency immediately. Should additional assistance be required, co-operation between and preparedness of States should ensure a more timely response.

The AFS Convention will stop the leaching of harmful compounds from the hulls of vessels both within and transiting adjacent to the PSSA, thereby reducing the levels of TBT in the water column and preventing further deposition within sediments.

6.2.9. EU Policy

Changes in EU Shipping Policy since the designation of the Wadden Sea include: the Third Maritime Safety Package which was adopted in April 2009, Regulation (EC) No. 782/2003 on the prohibition of organotin compounds on ships and Directive 2005/35/EC on ship-source pollution and the introduction of penalties for infringements.

6.2.9.1 The Third Maritime Safety Package

After the pressure caused by both the public and political outcry following the 1999 Erika accident, in which 20,000 tonnes of heavy fuel oil was washed onto the French coastline, the European Commission was forced to take action to improve maritime safety. The Commission proposed three new safety packages known as Erika I, Erika II and the Third Maritime Safety Package. The majority of the Directives under both the Erika I and Erika II packages were implemented prior to the designation of the Wadden Sea PSSA in 2002. The Third Maritime Safety Package was adopted in April 2009 and therefore still needs to be established. This package proposes seven measures, which are detailed below:

6.2.9.2 Directive 2009/16/EC The role of Port State Control

This Directive calls for further measures to improve Port State Control, in order to ensure that the condition of ships entering and leaving EU ports pose a low risk with regard to both the safety of the crew and the environment.

6.2.9.3 Directive 2009/21/EC Compliance with Flag State requirement

The purpose of this Directive is to ensure that EU flags are all of good standing with none being black or grey listed under the Paris Memorandum of Understanding. Furthermore, the IMO voluntary flag State audit scheme will be integrated into EU law making it compulsory for all EU flagged ships to comply with auditing requirements.

6.2.9.4. Directive 2009/15/EC Common rules and standards for ship inspection and survey organisations and for the relevant activities of maritime administrations.

This Directive has been developed in order to make the procedure for inspection of Classification Societies more thorough and to authorise the Commission to perform

audits and impose penalties if they do not meet a certain standard. Furthermore, this Directive aims to “give legal certainty to stakeholders” (European Commission, 2009b). This has been reinforced by Regulation (EC) No 391/2009 on common rules and standards for ship inspection and survey organisations.

6.2.9.5 Directive 2009/17/EC (amending Directive 2002/59/EC) Establishment of a community vessel traffic monitoring and information system.

This Directive aims at improving both the collection of data and the transfer of data between EU countries by establishing a network specifically for this purpose. The concept of places of refuge and the decision making process has also been improved. The Directive also states that Automated Identification Systems (AIS) will be fitted to fishing vessels over 15m in length, which should improve safety and reduce the risk of collision between commercial shipping and fishing vessels.

6.2.9.6. Directive 2009/18/EC Fundamental principles governing the investigation accident in the maritime transport sector and amending council Directive 1999/35/EC and directive 2002/59/EC of the European Parliament and of the council.

This Directive aims to provide comprehensive guidelines for all EU States regarding technical investigations. The maritime accident investigation Directive will be similar to that of the civil aviation industry as they will not seek to establish or apportion blame, but to provide information in order for lessons to be learnt and to help prevent future incidents.

6.2.9.7. Regulation (EC) No 392/2009 Liability of carriers of passengers by sea in the event of accidents - Liability of Carriers (Athens Convention)

The purpose of this Regulation is to establish a set of rules with respect to compensation for passengers onboard cruise ships or ferries in the event of an accident. This set of rules must be current and standardised and will be comparable to those for road, rail and international travel.

6.2.9.8. Insurance Directive 2009/20/EC Insurance of ship-owners for maritime claims

At present “there is no general obligation to be insured under international law”; this new Directive will require all EU flagged ships and any non-flagged EU ships which use European ports “to be insured against damage to third parties caused by their ships” (European Commission, 2009d).

6.2.9.9. Regulation (EC) No. 782/2003 on the prohibition of organotin compounds on ships

In 2003 the European Parliament passed Regulation (EC) No 782/2003 on the prohibition of the use of organotin compounds on ships. These organotin compounds are most commonly found in the anti-fouling paints that are used on the hulls of ships, the most commonly known being Tributyl tin (TBT). Over the years various studies have concluded that these compounds are highly toxic to marine species particularly filter feeders e.g. molluscs. The Regulation applies to any ship flagged under a Member States flag or any ship which is operating under the authority of a Member State but not flagged under them and also any ship that is not falling within the previous, but which is entering an EU port (Europa, 2006).

6.2.9.10. Directive 2005/35/EC on ship-source pollution and introduction of penalties for infringements.

In 2005 the European Parliament established Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements; this states that overboard discharge of any noxious substance is an offence which is punishable. This Directive applies to any ship navigating in European waters. Under the Directive it is an offence to discharge noxious substances in the following areas:

- Internal waters, including ports, of a Member State;
- Territorial waters of a Member State;
- Straits used for international navigation subject to the regime of transit passage, as laid down in the 1982 United Nations Convention on the Law of the Sea (UNCLOS Articles 37 - 39)
- Exclusive Economic Zone (EEZ) of a Member State;
- High Seas.

(Europa, 2009)

6.2.9.11. Integrated Maritime Policy & Marine Spatial Planning

In 2007 the EU Commission presented its vision for an Integrated Maritime Policy for Member States “In its strategic objectives for 2005-2009 the Commission declared the particular need for an all-embracing maritime policy aimed at developing a thriving maritime economy, in an environmentally sustainable manner. Such a policy should be supported by excellence in marine scientific research, technology and innovation” (Van Houdt, 2008).

The Integrated Maritime Policy “will encompass all aspects of the oceans and seas in a holistic, integrated approach,” where the Commission “will no longer look only at compartmentalised maritime activities, but... will tackle all economic and sustainable development aspects of the oceans and seas, including the marine environment, in an overarching fashion” (Commission of the European Communities, 2007, p4). There is a further aim to “develop policies and legislative proposals that are coherent and mutually compatible” (Commission of the European Communities, 2007, p6), which would bring all Member States in line with one another. The establishment of united policies and inter-linking between industry (economic) and environment will strengthen the sustainability of Europe’s maritime sector. The European Commission have also established a European Maritime Day, which will inform and update stakeholders of progress that has been made amongst the maritime community.

The Commission adopted the Roadmap for Maritime Spatial Planning: Achieving common principles in the EU in 2008, “Maritime Spatial Planning (MSP) is a key instrument for the Integrated Maritime Policy” (Commission of the European Communities, 2008, p2). Current marine spatial planning practices within the EU, as well as key principles and underlying issues are discussed within the document.

6.2.10. Discussion on EU Policy

The seven directives introduced under the Third Maritime Safety package, have the potential to be positive for the Wadden Sea PSSA. The improvement of the role of Port State Control should ensure vessels in the area are of an appropriate standard and thereby pose less of a risk. Standardisation and conformity amongst vessels flying EU flags should see the quality of vessels improve and the removal of flags appearing on black lists, where they are deemed to be sub-standard and pose a higher risk to both the safety of crews and the environment. This will also be addressed through the standardisation of rules for inspection of vessels in the EU. The insurance Directive is also aimed at reducing the number of sub-standard ships, as they will be unable to get insurance due to the higher risk they would pose to insurance companies.

The establishment of community VTS where there is co-operation amongst neighbouring countries will enable the tracking of vessels in the area carrying dangerous cargoes and identification of ‘rogue’ vessels whose actions are cause for concern. The

introduction of automated identification systems (AIS) on fishing vessels larger than 15m in length should also improve safety and reduce risk of collision in the area.

Regulations relating to the prohibition of organotin on ships align with the requirements of the IMO Anti Foulings Convention and will have the same impact at reducing introduction of Tributyltin (TBT) into the water column and sediments. Likewise the Directive on shipboard pollution aligns with both the MARPOL Convention and the London Convention protocol.

Marine spatial planning has come to the forefront over the past few years and will become even more vital in the future due to the increasing competition between industries for use of the sea. This is especially true in European waters with the development of offshore wind parks and increasing activity in the shipping industry. MSP is designed to “help(s) public authorities and stakeholders to coordinate their action and optimises the use of marine space to benefit economic development and the marine environment” (Commission of the European Communities, 2008, p2). Additionally, MSP creates a framework for evaluating and assessing human activities in order to manage any impact that they have on the marine environment. This may seem simplistic but the oceans/seas are complex ecosystems which cross over States borders, therefore to address this appropriately action should be taken at a higher level. MSP will provide a discussion platform for Member States to “develop a holistic approach to the management of maritime activities in line with ecosystem requirements” (Commission of the European Communities, 2008, p3), resulting in the same approach being used by neighbouring countries instead of two different systems for the same piece of water.

6.2.11. Changes to policy and current ship safety and security measures in the Wadden Sea area

6.2.11.1. Automatic Identification System (AIS)

Since the Wadden Sea PSSA designation in 2002 the most significant addition to ship security, surveillance, navigation and identification has been the requirement for all vessels of 300 gross tons and above engaged on International voyages, all vessels of 500 gross tons and above not engaged on international voyages and all passenger vessels irrespective of size to be fitted with an Automatic Identification Systems (AIS)³⁸. This system transmits data including: ships identity, type, course, speed, navigational status

³⁸ Regulation 19, SOLAS Chapter 5 became effective for all vessels in December 2004

and other safety related information, automatically to ships, aircraft and shore based facilities.

6.2.11.2. Traffic Separation Schemes (TSS)

Due to the high density of shipping activity in the southern North Sea the IMO has implemented traffic separation schemes in order to simplify the traffic flow and therefore reduce the risk of collisions. The main routes are:

- The Deep Water Route from North Hinder to the German Bight via the Frisian Junction.
- The Traffic Separation Scheme (TSS) from North Hinder to the German Bight via the Frisian Junction.
- The TSS from off Vlieland to the Terschelling German Bight which joins the Deep Water Route at the Jade Approach.

The Deep Water Route is mandatory for the following classes of ship:

- Tankers of 10,000 GT + carrying oils as defined under Annex I MARPOL 73/78
- Ships of 5,000 GT + carrying noxious liquid substances in bulk categories A or B of Annex II of MARPOL 73/78
- Ships of 10,000 GT + carrying noxious liquid substances in bulk categories C or D of Annex II of MARPOL 73/78
- Ships of 10,000 GT + carrying liquefied gases in bulk.

(UKHO, 2007)

6.2.11.3. Vessels Traffic Services (VTS)

Denmark currently has no VTS arrangements in the North/Wadden Sea area.

The Netherlands has five systems which cover the North/Wadden Sea areas, these are shown below:

- Den Helder VTS- All vessels equipped with VHF are required to participate in the service and all vessels must report when entering or leaving the VTS area.
- Terschelling VTS - compulsory reporting for all vessels when entering or leaving the VTS area.
- Schiermonnikoog VTS – provides radar surveillance for the Terschelling - German Bight TSS
- Delfzijl VTS – is mandatory of all vessels entering or leaving the area.

- The Wadden Sea Central Reporting Station - is responsible for co-ordinating all relevant maritime authorities in event of an incident in the Wadden Sea area.

Germany provides extensive VTS coverage throughout the North/Wadden Sea area, with VTS surveillance in both the coastal areas and inner estuaries the most relevant are shown below:

- The Ems VTS
- The Elbe VTS
- The Jade VTS
- The Weser VTS

All of the above German VTS are mandatory for vessels carrying dangerous goods in bulk and whilst in the VTS area a permanent listening watch on VHF radio must be maintained. Sailing plans should be submitted for all vessels:

- Over 50m in length (over 40m for the Ems),
- Carrying dangerous cargo in bulk,
- Tankers which are in ballast, but have not been cleaned, degassed or completely inert after carrying petroleum or petroleum products with a flashpoint below 35°C
- Nuclear vessels.

The German Bight VTS is mandatory for all vessels entering the area, under this service a permanent listening watch on VHF radio is required. Sailing plans are also required for all vessels over 50m and all vessels carrying dangerous cargo in bulk.

(World VTS Guide, 2009)

6.2.11.4. Pilotage

In Denmark pilotage is compulsory for tankers over 60m in length when entering Esbjerg, also under the Danish Pilotage Act no. 567 of 09/06/2006 vessels carrying certain cargoes are obligated to be under pilotage. This includes vessels which are:

- Carrying oil or have un-cleaned cargo tanks that have not been rendered safe with inert gas.
- Carrying chemicals/gases/highly radioactive material.
- Have more than 5,000t bunker oil on-board.

In the Netherlands harbour pilotage is compulsory for ships over 60m in length and for all vessels carrying oil, gas or chemicals. Also in the harbour of Harlingen pilotage is

compulsory for all vessels. Additionally, for tankers required to use the deep water route a voluntary deep sea pilotage can be taken on-board.

In Germany compulsory pilotage is required for certain types of vessels on all of the main shipping routes and approach channels. For the Rivers Ems, Jade, Weser and Elbe the following vessels require compulsory pilotage:

- Tankers carrying in bulk any of the following gas, chemicals, petroleum or petroleum products.
- Unloaded tankers which have not been cleaned, degassed or completely inerted after having carried petroleum or petroleum products with a flashpoint less than 35°C.
- Other vessels that exceed 90m in length or breadth of 13m.
- Vessels with a draught of more than 8m require pilotage on the River Jade.
- Vessels with a draught of more than 6m require pilotage on the R. Ems.
- Vessels which are bound for Bremerhaven on the R. Elbe require pilotage if there draft is over 8m, if the vessel is going beyond Bremerhaven then pilotage is required if the draught is more than 6.50m.

For the German Bight compulsory pilotage is required for the following classes of vessels:

- Tankers which are > 150m in length or have a beam > 23m if not gas free or fully inerted when bound to/from the River Ems, Jade, Weser or Elbe
- Bulk carriers which are > 220m in length or have a beam > 23m when bound to/from the River Elbe.
- Bulk carriers which are > 250m in length and have a beam > 40m or more than 13.5m draught when bound to/from the Rivers Jade or Weser.
- All other vessels which are > 350m in length or have a beam > 45m when bound to/from the Rivers Jade, Weser and Elbe.

(UKHO Admiralty Sailing Direction North Sea Pilot, 2007)

6.2.12. Summary of shipping related regulations and policy

Since 2002 the International and European communities have introduced several important pieces of legislation aimed at protecting the environment from shipping activities. These policies have and will continue to improve the both the standard

and safety of shipping, thereby reducing their potential negative impact on the marine environment. For the Wadden Sea, amendments to existing legislation and the introduction of new legislation should also improve the quality of the marine environment. Furthermore the development of the EU Integrated Maritime Policy will assist with bringing countries coastal policies in line with each other, thus encouraging and enabling them to develop further policies together specifically aimed at protecting vulnerable areas such as the Wadden Sea.

CHAPTER 7

MEASURING THE STATUS OF THE WADDEN SEA PSSA

7.0 Evaluating effectiveness of PSSA designations

In order to aid with the design of an appropriate framework for evaluating the effectiveness of a PSSA, the thoughts and opinions of experts were sought. Those approached had been involved in the development of the PSSA guidelines, had assisted with a submission for designation of a PSSA or else had written extensively about the PSSA concept.

7.1. Expert Group

Eleven experts were identified and approached, out of which nine agreed to participate (5.2.4., Table 5) by completing an emailed questionnaire where they could express their opinions and views on the major challenges that surround both the designation of PSSAs and the effective management of these areas.

7.1.1. Questionnaire

Eight questions were asked in order for the experts to identify key issues and perceived areas of concern with PSSAs. Open questions were used so that the respondents could be as expansive as they wished. A copy of the questionnaire is contained in Appendix B. Analysis of the responses received identified that there were several areas where the experts held very similar views (précis of experts responses in Appendix C) and these were therefore deemed to be of particular significance to the development of the evaluative framework, these fell into five general areas:

- Function of PSSAs as a protective mechanism
- Appropriateness of existing designations
- Legal and regulatory framework
- Stakeholder awareness
- How to measure effectiveness of a PSSA

Each of these areas are discussed in the following sections.

7.1.1.1. Function of PSSAs as a protective mechanism

It was identified by some of the respondents that PSSAs were currently not fulfilling their true potential as a protective mechanism. It was suggested that the application of the concept itself is still unclear. For example, should a designation be applied to a wide geographical area which may contain several different ecosystems, each of which may have a specific vulnerability that needed addressing, or should it be applied to just

the most outstanding areas? Alternatively should a PSSA be applied to any environmentally sensitive sea area that meets the criteria within the guidelines? The opinion of some of the experts was that this lack of clear definition leaves the concept open to abuse and therefore may reduce the value of an area being designated a PSSA.

Some of the experts were of the opinion that current PSSAs generally ignore the shipping sector as a whole as they are not represented well on nautical charts or promulgated to mariners effectively. This in turn leads to a lack of knowledge and understanding of the concept amongst the shipping industry and mariners themselves. Finally it was stated that PSSAs may be helping the conservation of designated areas but the majority of the designated PSSAs are located in developed countries and therefore are not fulfilling their function in an equitable manner.

7.1.1.2. Appropriateness of existing designations

Since 1990, when the Great Barrier Reef was designated as the first PSSA, there have been eleven new PSSAs and one extension to an existing PSSA. Not all of the designations are seen as appropriate, one reason being that when taking into account the IMO's definition of a PSSA, specifically "*where such attributes may be vulnerable to damage by international shipping activities*" (Resolution A.982(24)1.2) some areas do not meet this criteria. For example, the Galapagos PSSA is located in an area which clearly fulfils most criteria, but does not however, appear to be under threat from international shipping, as major shipping lanes are located away from the area, so the major threat comes from national traffic which can be legislated through other measures available.

Other designations are seen by the experts as inappropriate due to either the lack of or type of Associated Protective Measures (APM) linked with the designation. Under Resolution A.982 (24) 7.1, when States submit an application for a PSSA designation it "*should contain a proposal for an associated protective measure*" to help address the areas specific vulnerabilities. All of the experts questioned the appropriateness of certain APMs. The Western European, Wadden Sea and Baltic Sea PSSAs were those most commonly cited by the experts as having inappropriate APMs. With respect to the Wadden Sea it was noted that APMs were outside the designated area and therefore the designation appeared to have no directly associated APM, the lack of delineation on hydrographic charts was also mentioned. Furthermore it was suggested that if a country included a protective mechanism which was in place prior to the designation as their APM, it was then unclear as to what exactly the purpose of the designation was.

The experts also commented that some of the designations are misdirected or their purpose unclear. An example of misdirection is the Western European PSSA which was submitted following a string of accidents involving major oil spills within the proposed area. This PSSA encompasses a vast area with several different types of ecosystems and includes World Heritage Sites and other protected areas. Due to the extent of the area, actual vulnerability to shipping varies throughout, and, as such, a range of AMPs could have been incorporated. However, only one APM exists, this being mandatory reporting. At submission a second APM was proposed, which suggested a ban on single hulled tankers transiting the area. This was not an APM that currently existed within the remit of the IMO and was seen by some as the reason behind the designation, thereby questioning the appropriateness of such a designation.

Whilst this measure was disallowed it did however force the issue of phasing out of single hulled tankers by the IMO which has now been accelerated.

7.1.1.3. Legal and regulatory framework

The PSSA concept in itself is not legally binding as it is a Resolution and not a Convention. Therefore only the APMs have a legal basis. If no APMs are included in the designation then the concept is not being used to the best of its potential. The APMs are legally binding as they exist under other IMO instruments such as MARPOL Special Areas or Ship Routeing. However, these are not the only measures that can be established. If the PSSA is located within the Territorial Sea the Coastal State may exercise their own rights under the United Nations Convention on the Law of the Sea (UNCLOS) and therefore can implement measures under national law. An example of this was given as measures adopted by the Florida Keys PSSA, which included designation of ‘no anchoring zones’ through US National law.

It was also suggested that there should be a mandatory requirement for evaluation and reporting of shipping incidents and accidents within and adjacent to PSSA boundaries. In so doing it would help to demonstrate the effectiveness of the designation as a protective mechanism and would also highlight any new vulnerability that may arise and which needed addressing. In conjunction with this, it was put forward that monitoring of designations should be a continuous and ongoing process to ensure that they meet or are adapted to meet the changing nature of vessel characteristics within and adjacent to the area.

7.1.1.4. Stakeholder awareness

Stakeholders should include every group who are associated with the marine environment including non-profit groups such as non-governmental organisations (NGOs), governmental bodies such as conservation and tourism offices, fishery agencies, and national protection agencies. Furthermore mariners and those who depend on the marine environment for their livelihoods such as fishermen, tour guides and pilots should also be included as stakeholders. Currently the level of communication amongst mariners and stakeholders is seen to be insufficient. It was stated that ‘fishermen, tourism industry and seafarers must be better informed of purpose in order to understand benefits and how to follow Regulations’. It was also suggested that promulgation to mariners and identification of PSSAs on nautical charts must be brought inline and made consistent, in order to increase awareness across the sector. Comment was also made with respect to the shipping sector, who should be better informed about PSSAs and the fact that whilst they do help to protect the environment they also have socio economic benefits with respect to the fishing and tourism industries.

7.1.1.5. How can you measure effectiveness of a PSSA?

The purpose of a PSSA is to protect a sensitive sea area that is vulnerable to international shipping so for this to be effective the measures established must eliminate or reduce the risk in order to protect the vulnerable area. There was a consensus that any effort to measure effectiveness needs to start before or at the time of designation. An evaluation of such an area is a complex situation and the monitoring of both environmental and shipping indicators should be established before designation or at the time of designation so that a baseline can be established. This baseline can then be utilised to give the level of risk and state of the environment before the designation allowing for a comparison to take place at a later date to establish the effectiveness of the PSSA. The baseline data could also be used to help inform and prescribe the most appropriate APM to address specific vulnerabilities.

In order to evaluate a PSSA the following questions should also be asked:

- What were the objectives of the designation – has the designation met these objectives?
- Was a management plan identified and implemented to monitor the designation and has it benefited the area?

- Is there a clear linkage among the attributes of the area, the specific vulnerability and the APM?

All the experts stated that the development of the APMs was vital for an evaluation of a PSSA as it is these that provide protection. If there are no existing APMs a risk analysis should be conducted in order to identify the most appropriate APM. However, if APMs are already in place then regular monitoring should be undertaken to evaluate the effect that the APM is having on the identified vulnerability. This would establish whether APMs have decreased vulnerability and if not what additional measure can be put in place.

The level of the stakeholder's knowledge and understanding of the PSSA concept should be evaluated and if required additional effort should be made to increase the level of understanding and awareness.

The experts also stated that in their opinion environmental indicators and vessel traffic characteristics of the area should be regularly assessed in order to understand what if any changes have occurred and what these may be attributed to. To do this the following monitoring systems should be established:

- Periodic evaluations to compare environmental damage, or the risk posed by shipping, both before and after the PSSA designation.
- Vessel monitoring systems which should be utilised to establish if there have been any notable changes in vessel traffic characteristics and number of incidents/accidents.

By monitoring both the marine environment and shipping and identifying common factors that can be used as indicators, over time, it should be possible to identify the effect of the PSSA and whether there has been a positive or negative change of state within the area.

7.1.2. Summary of responses from experts

From the responses of the experts to the questionnaire the general consensus was that existing PSSAs are generally not fulfilling their true potential as protective mechanisms. The main reasons for this were noted as a lack of true understanding of the concept of a

PSSA, lack of appropriate management plans and poor communication of their function and purpose to key stakeholders. Some of the experts also put forward that current PSSAs are not implemented effectively, which undermines their success. Furthermore it was suggested that in order to ascertain whether a designation was effective it was necessary to evaluate the area prior to designation and to monitor the area regularly after designation; this should be done in conjunction with the development of an appropriate management plan.

7.2 Develop an Evaluative framework

In order to overcome these shortcomings and to measure the effectiveness of the Wadden Sea PSSA it was necessary to develop an evaluative framework that could be utilised to identify and highlight key issues that are associated with the marine environment, shipping and PSSAs. The methodology behind the framework is discussed in Chapter 2. The Pressure State Response framework was identified as the most appropriate due to its adaptability. In order to populate the framework a series of indicators were identified, the choice of which were predicated upon definite links to shipping and potential impact on marine environmental quality. The initial list of indicators consisted of 17 pressure indicators, 16 state indicators and 6 response indicators (Appendix D). These were ranked using a Likert scale using two general declarative statements and one site specific statement (section 2.2.5.2, p14). The process identified key indicators with high (ranked above 45) or moderate (ranked above 35) relevance values to the Wadden Sea PSSA. (Table 8)

Once these key relevant indicators had been identified data that was available from the CWSS and other sources was examined to establish if the existing data was sufficient or if any further data was required.

Table 7. Pressure, State, Response Indicator suite (source: Author)

Pressure Indicator	State Indicator	Response Indicator
Shipping volume by type	TBT	Development of APMs
Shipping incidents	Invasive species	Communication to mariners
Collision – low impact		Co-ordination between states
Collision – high impact		Oil spill response
Oil spills reported		Stakeholder awareness
Oil spills by type/volume/coverage		
Offshore development		
Dredging		

7.2.1. Availability and quality of data

Data was reviewed from several sources including articles, books, the internet, the Wadden Sea Quality Status Reports (QSR) and the World Heritage Site nomination report. The majority of environmental and ecological data was obtained from the Trilateral Monitoring and Assessment Programme (TMAP). The source and type of data available is discussed in the following section.

7.2.1.1 Ecological and environmental data

The TMAP is a monitoring system for the Wadden Sea including the offshore area and islands; it contains both ecological and chemical parameters and is co-ordinated by the Trilateral Monitoring Assessment Group (TMAG). The TMAP covers the following areas:

- Birds (breeding birds, beached birds, breeding success, migratory birds)
- Habitats (beaches and dunes, salt marshes, sea-grass)
- Marine species (mammals, macro-algae, macro-zoobenthos, phytoplankton)
- Chemical parameters (bird eggs, fish, blue mussels and sediment)

These areas closely align with the reporting requirements of the following Directives and Conventions.

- Ramsar Convention
- World Heritage Convention (WHC)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS/Bonn Convention)
- Agreement on Conservation of Seals in the Wadden Sea 1990
- OSPAR Convention (within JAMP³⁹)
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)
- Birds Directive
- Habitats Directive
- The Water Framework Directive
- Marine Framework Strategy Directive (newly enacted)

Whilst data from TMAP was readily available, there were some areas of concern with regard to lack of coherence and consistency of data, as different methods were used by the three reporting States during data collection/monitoring. This is supported by two

³⁹ Joint Assessment and Monitoring Programme

statements from the 2009 QSR, “the evaluation of present levels against background estimates is difficult because the three Wadden Sea countries use different estimates. Also different time windows and different statistics are used” (Van Beusekom *et al*, 2009, p. 14) and “recently, doubts arose whether the chlorophyll measurements by the different agencies and research institutes were comparable” (Van Beusekom *et al*, 2009, p. 7).

All stations where TMAP data are collected have a code; however specific co-ordinates were not readily available. Many of the monitoring sites are located away from shipping lanes between the fringing islands and mainland where international maritime traffic is not found. Therefore, some of the data was seen as not particularly appropriate to the area of study. Furthermore many of the ecological and environmental parameters of the available data were ranked as being of low relevance because the TMAP was not designed to monitor the impacts of shipping and therefore with respect to the indicator suite a clear and direct link to shipping could not be established. The TMAP produces a QSR every 5 years which aims to:

- Provide a scientific assessment of the status and development of the Wadden Sea ecosystem
- Assess the status of implementation of the trilateral targets of the Wadden Sea Plan

Some basic data for industry such as shipping and tourism is compiled in the QSRs, with some data being extracted through the TMAP database. However because some of the data used within the QSRs were not part of the TMAP it was not owned and stored by the TMAP data units, which in turn raised difficulties with access to and ownership of data.

7.2.1.2. Shipping data

Shipping data is not monitored or recorded through the TMAP and is currently collected by each individual country. Gaining access to shipping data for this research was problematical. One of the major issues was identification of those departments responsible for monitoring, collating and archiving of shipping data. Furthermore it was established that quality and quantity of the collected data was inconsistent and incomparable.

Shipping data received from the Netherlands was in the form of a single MARIN report from 2006, which only represented shipping incidents within that year; no further data was made available. Useable data for Germany was available for the south western area and the northern section of German waters and the EEZ. The shipping data received was found to vary greatly, with each of the States recording different information. The data provided did not include a classification system attached to the description and generally used non-specific terms when describing the type of incident e.g. 'trifle accident' and 'less heavy accident at sea'. From which it was not possible to identify the extent or impact of an incident. This non-conformity for collection of shipping data was of concern, as shipping reporting requirements and monitoring responsibilities were identified as a potential burden with respect to the trilateral Wadden Sea area in the feasibility study undertaken by Southampton Institute in 2001.

7.3. Risk assessment using the evaluative framework

The following section describes the findings of the indicators identified as of high to moderate relevance to the Wadden Sea PSSA (Table 7) from analysis and review of available data. Pressure indicators are discussed in section 7.4, State indicators in section 7.5 and Response indicators in section 7.6. Each indicator section ends with a discussion of the findings.

7.4. Pressure indicators

The key pressure indicators identified from the PSR framework were shipping volume by type, shipping incidents, collision–low impact, collision–high impact, oil spills reported, oil spills by type/volume/coverage, offshore developments and dredging.

7.4.1. Shipping Volume by Type

Since the Wadden Sea was designated as a PSSA the tonnage of the world merchant fleet has increased from 844.2 million tons to 1.12 billion tons. Figures from International Shipping Logistics (ISL) reports for the port of Hamburg over the same period show a growth of cargo tonnage from 98.3 million tons to 140.9 million tons with container throughput increasing from 4.69 million TEUs⁴⁰ (Cargo Systems, 2002) to 9.9million TEUS (ISL, 2008). Whilst all vessels can be a threat to the marine environment, certain vessels pose a higher risk due to the nature of the cargo they carry. Knowledge of the volume and type of shipping within or passing through an area is

⁴⁰ Twenty foot equivalent unit

invaluable for the development of emergency response plans and for ensuring that appropriate oil spill response equipment is available as required by the OPRC-HNC Protocol.

Tankers carry many different categories of cargos which if released into the marine environment can cause extensive damage to both the environment and economy of the affected area. Whilst new legislation is in place with regard to construction of new tankers, there are still tankers in operation that do not meet these higher standards. Container ships are increasing both in size and number. These ships transport all types of cargo from consumer products to hazardous materials. Over the past few years there have been an increasing number of incidents where container ships have grounded, additionally the number of containers being lost overboard is also on the increase. Lost containers pose a threat not only to the marine environment but also to shipping as they generally float just below the waterline and can easily cause hull ruptures should a vessel come into contact. At present there is no financially viable way of tracking the location of containers lost overboard.

7.4.2. Shipping incidents and Collisions

Shipping incidents can vary in size and the impact that they cause to the environment, for example a small sailing vessel which runs aground causes little if any harm to the surrounding environment, however an oil tanker which runs aground can cause extensive and devastating damage to the environment, flora and fauna as well as to the economy of the area. This damage can be felt and seen for several months or even years. Due to the high level of international shipping, fishing, construction and offshore vessels operating within the area adjacent to the Wadden Sea, as well as a significant numbers of recreational boats, there is a probability of a collision of some sort. However the risk of a high impact and potentially devastating collision can be reduced to the lowest possible level practicable through controlling and monitoring vessel movements within an area. For this reason there is a need to clearly identify and differentiate between what is deemed to be a low or high impact collision and where they occur in order to identify 'hot spots' that may require additional measures to be implemented to reduce risk further.

7.4.3. Oil Spills - Reported, Type, Volume/Coverage

In 2008, 2.75 billion tons of tanker cargoes were shipped around the world, of which 483.4 million tons was unloaded in Europe (UNCTAD, 2009). There are several major oil terminals and refineries in North Europe; consequently there is a large volume of tanker traffic passing through the North Sea. Wilhelmshaven is a major oil terminal and refinery within the Wadden Sea, with an annual capacity of approximately 30 million tons (World Port Source), producing 260,000 barrels/day of refined products (ConocoPhillips, 2007b).

Aerial surveillance for identification and reporting of spills is undertaken by the Wadden Sea States in accordance with the Bonn Agreement. This ensures that a continuing and systematic surveillance is undertaken by member States. The current data from the Bonn Agreement shows the density of oil pollution in the North Sea and the location of spills, however due to the large area that requires monitoring there is a probability that some pollution incidents are not observed. The need to identify and assess oil spills is paramount to ensure that appropriate and rapid response can be undertaken and that those responsible for the spill can be identified and prosecuted.

There are many different grades of oil which all have different viscosities and properties and the ability to identify both the type and size of any oil spill is vital to ensure appropriate action is taken. The Bonn Agreement Oil Appearance Code in conjunction with the use of satellite imagery⁴¹ are positive actions that can greatly assist with rapid identification and response. However it is of great importance to ensure that all incidents are accurately reported in order to assess the level of threat and whether additional action needs to be undertaken to reduce the risk further.

7.4.4. Offshore Development

The North Sea has been producing oil and gas since 1970s, with the majority of the platforms located on the continental shelves; therefore they pose limited risk to the Wadden Sea ecosystem. However there are also several fields located under the Wadden Sea which are used to produce gas, the Netherlands sector of the Wadden Sea currently has five fields under or partially under it. Under the Wadden Sea Plan “new exploitation installations for oil and gas will not be permitted” in the Conservation Area, despite this it also states that if “deposits can be exploited from outside the

⁴¹ Through EMSA and CleanSeaNet

Conservation Area” then exploration activities are permitted within the area (Wadden Sea Plan, 1997 WSP § 4.1.10).

The Wadden Sea Conservation Area contains three offshore platforms (Mittelplate, Zuidwal and Laybucht) and the adjacent North Sea has several offshore energy platforms. At present they are mainly oil and gas platforms; however there are a growing number of wind parks. The oil and gas platforms are located away from the main shipping lanes therefore should not pose a high risk with respect to vessel traffic. However with the development of the offshore wind parks in the German Economic Exclusive Zone (EEZ), which includes the German Bight Traffic Separation Scheme (TSS), an increased amount of traffic will be seen crossing the Wadden Sea and the inner TSS during the construction phases of these projects. This may increase the risk of collisions as supply and construction vessels will have to cross the TSS. Generally, offshore installations do not pose a significant risk as there is an exclusion zone for ships around them, however there is evidence that collisions do happen.

7.4.5. Dredging

The main shipping channels of the Wadden Sea require continuous dredging to enable safe passage of vessels to and from the ports. The major concern lies with the spoil that is removed and where it is dumped. The material that is removed from these channels and harbours will contain contaminated material such as TBT and other ship sourced pollutants within the sediment (see section 6.6.1). Whilst over time TBT will decompose, the half-life within sediment can be measured in years. Therefore by dumping at a new location the contamination is spread. In the Wadden Sea the main dumping sites are located within the PSSA where currently there appears to be no evidence of negative impacts. However with the expansion of the Jade-Weser port and the extensive dredging that will be needed, in addition to planned projects for Eemshaven and Hamburg harbour (WSF, 2008), this requires careful monitoring.

7.4.6. Discussion of Pressure indicators

7.4.6.1. Shipping

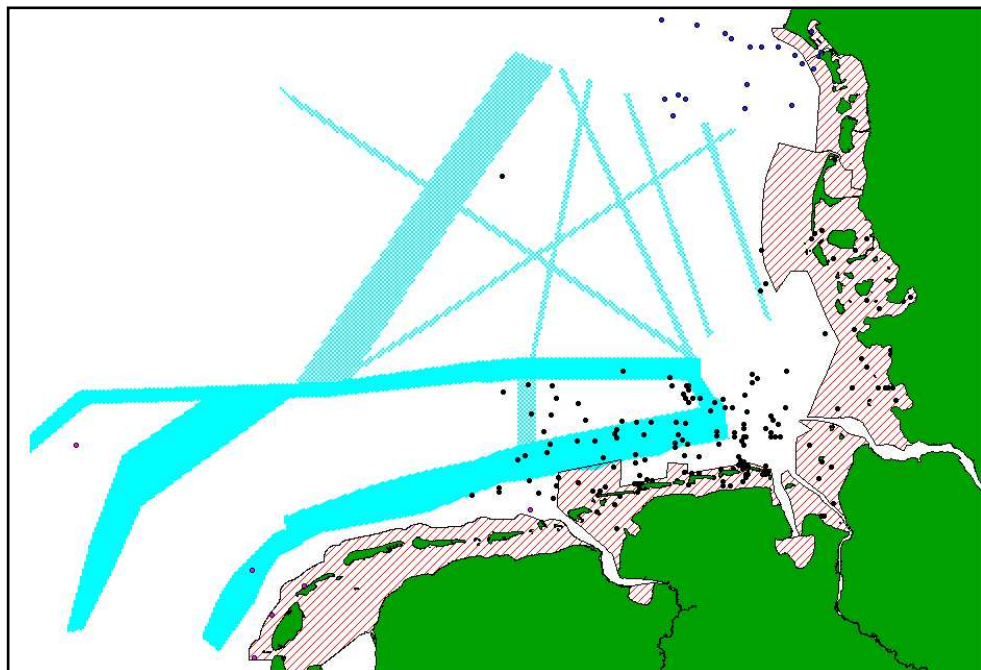
Shipping data that was useable was inputted into the GIS model (Figure 6) to show the locations of incidents in order to identify any potential problem areas. As the data from the Netherlands only represented one year it was not possible to accurately identify any long term patterns within their area. From the German data received it was noted that accidents are occurring both within and around the traffic separation scheme. From the

GIS model it can be seen that a major area of concern is located around the Jade Approach where the vessels enter or leave the traffic separation scheme (TSS) and pick up/drop off pilots.

Since the designation of the PSSA it is evident that accidents are still occurring both within the Wadden Sea PSSA and the adjacent shipping lanes. However the data does indicate that there have been no major incidents since the Pallas in 1998⁴². The majority of reported/recorded incidents in the Wadden Sea since 1990 have been low impact incidents with a number of small collisions. Despite this it cannot be said if these have resulted in any pollution, as this data was unavailable.

Data for types of vessels transiting and using ports within the Wadden Sea area was not readily available; however estimates could be made by utilising data available from Institute of Shipping Logistics (ISL) reports. From the incident data received from the countries only the Federal Water and Shipping Directorate North West identified the type of ship involved in the incident.

Figure 6. Location of incidents from available data



Key: Red hatched – PSSA boundary, Blue block colour– TSS and Deep Water Route, Pale Blue dots-shipping routes, Black Dots – All Reported incidents from data received

⁴² The Pallas was a general cargo ship that caught fire 55nm of the Danish coast near Esbjerg spilling approximately 240 tonnes of heavy fuel oil into the Wadden Sea when she was stranded.

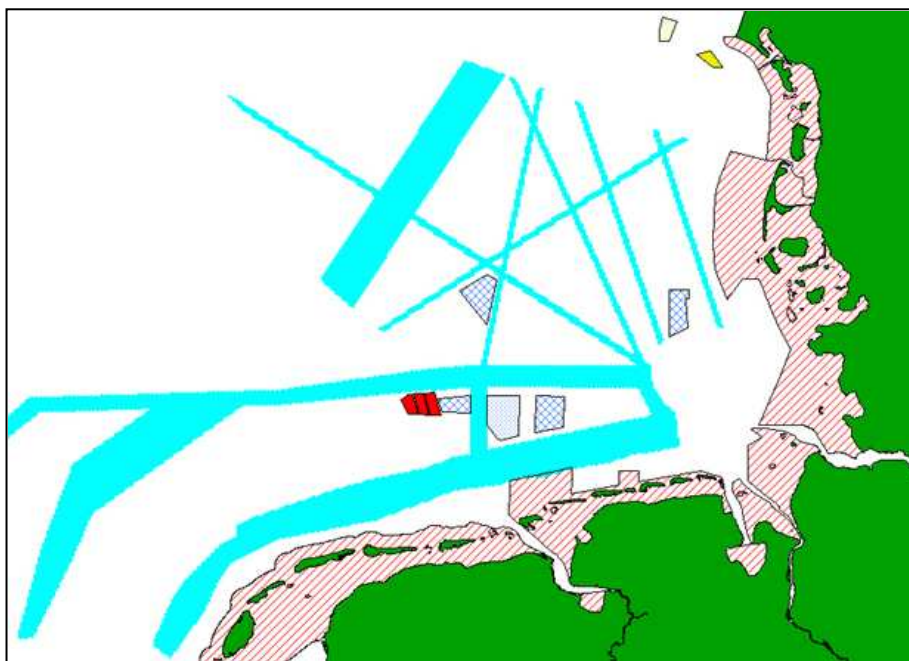
7.4.6.2. Oil spills

Data available relating to oil, as with shipping data, varied between the States. The data available from Germany and the Netherlands did not indicate the type of oil spilt, whereas the Danish data clearly classified the type of oil reported. The volume of oil spilt was not available for any State.

7.4.6.3. Offshore development

The location of existing offshore wind parks and those that have been approved for development were obtained from the German Federal Agency for Shipping and Hydrography (BSH) Spatial Planning documents (BSH, 2009a). These locations are shown in Figure 7, from which it is evident that there is a potential area of high risk to shipping, where vessels entering and leaving the ports of Emden and Delfzijl cross the inner TSS following either a northerly or southern route.

Figure 7. Location of wind parks – existing and approved for construction



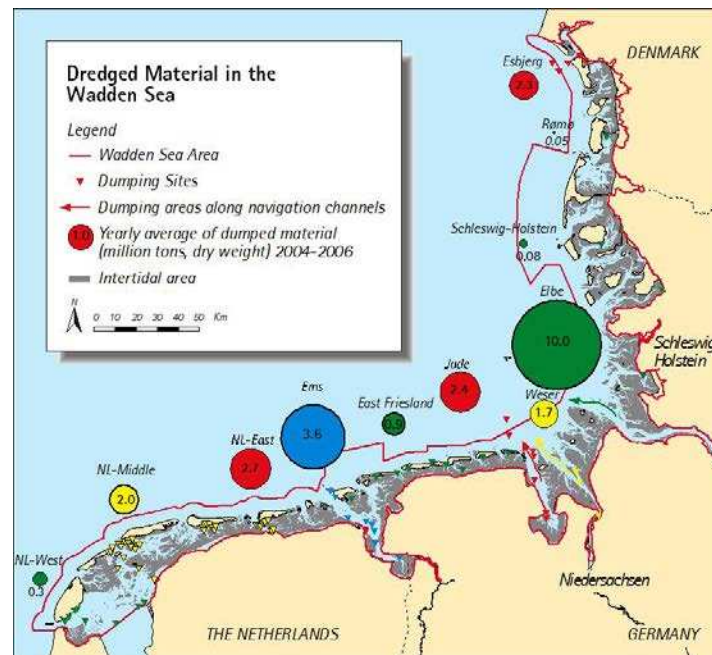
Key: Red hatched – PSSA boundary, Blue block colour– TSS and Deep Water Route, Pale Blue dots-shipping routes,

7.4.6.4. Dredging

From the data collected from monitoring sites around the Wadden Sea and despite the potential for harm from the spoil, currently no adverse effects have been identified. The majority of dredge spoil currently comes from the Elbe, but this is expected as it is presently one of the busiest navigation channels, with Hamburg seeing an estimated 40,000 ship movements in 2007 (Hamburg Port Authority, 2007, p16). The removal

and dumping of dredged spoil (Figure 8) may pose an increased risk to the Wadden Sea area during the construction of the Jade-Weser container port where a major capital dredge is required in order to deepen the approach channel to 18m. Data from the monitoring sites close to the Jade area indicates that the sediment in the area contains a higher level of TBT which has not yet broken down.

Figure 8. Map of dumping sites and yearly average amount of dumped dredged material in the Wadden Sea in the period 2004-2006.



Data source: OSPAR. (Nehls and Witte, 2009, p7)

7.5. State indicators

The key state indicators identified were TBT and invasive species; in addition the Steering Committee of the project felt that marine litter and oiled birds should also be included, even though both were ranked as being of low relevance within the indicator suite (see Appendix E) .

7.5.1. Tributyltin (TBT)

TBT is an organotin compound which, since the 1960s, has been used in anti-fouling paints, which are applied to ship hulls and other marine installations, such as oil platforms to prohibit unwanted biological fouling. This is important as organisms attached to the hulls of ships produce added drag which slows the ship down resulting in more time at sea and more fuel used. The idea of biocide and anti-fouling systems is not new, previously chemicals such as DDT and arsenic had been used. When TBT was

introduced into anti-fouling paints it was regarded as less harmful than its predecessors. However, in order to be effective TBT had to be at high enough levels to be toxic to organisms that attach to the ships hulls. Now “TBT has been described as the most toxic substance ever deliberately introduced into the marine environment” (IMO, 2002f, p5).

Over time TBT leaches from the painted hull into the water, here it can be broken down into less toxic chemicals by photolysis and biodegradation processes. However this decomposition process varies depending on environmental conditions. TBT has a high affinity for adsorbing onto sediment surfaces. So, if the area is heavily sedimented such as harbours and estuaries, the area could be contaminated for several years prolonging the risk to the environment and food chain. As buried, sediment bound, TBT has a greater half-life. Therefore, “it has been established that the main problem with TBT is its persistence in the marine environment” (IMO, 2002f, p6).

It has been found that TBT can disturb the hormone levels in molluscs, particularly dogwhelk (*Nucella lapillus*), which causes changes in sexual characteristics of the female molluscs (imposex), which will finally lead to a collapse of the viable population. This has been recorded in around 72 marine species. Furthermore studies have shown that traces of TBT have been found in marine mammals such as whales and dolphins as well as some fish species, which shows that the TBT is being absorbed via the food chain. This is increasingly worrying as TBT is also toxic to humans. In 1989, Germany issued “a ban on the use of organotin compounds as anti-foulants for ships less than 25 metres in length” (Federal Environment Agency Umweltbundesamt n.d.).

7.5.2. Invasive Species

Previously the location of species was limited by geographical and oceanographic barriers. However, with development of international trade, alien species have been introduced into “new areas in which they were previously absent and to which they have been introduced by humans as mediator” (Nehring *et al*, 2009, p3). Over recent years there has been a notable increase in the number of reported cases of invasive species, many of which have had a disastrous effect on the area. This, it is thought, both represents an increase in the shipping vector, but also the gradual degradation of these bio-geographic boundaries through climate change. It has been proven that many of these species are transported in the ballast water of ships.

7.5.3. Marine Litter

Marine litter is a global issue which causes serious damage as species can get entangled or ingest litter which can lead to death, it has also been well documented that it is a source of transport for invasive species (Fleet *et al*, 2009, p2). Marine litter can enter the Wadden Sea and surrounding North Sea from both land-based and sea-based sources, these include indirect sources such as rivers, drains, sewage and storm water outflows or the wind. Land-based sources include tourism, recreational visitors, and unprotected waste disposal sites, whilst sea-based sources include shipping (commercial and recreational), fisheries, and offshore installations.

The North Sea is designated as a MARPOL Annex V ‘Special Area’ which restricts the disposal of garbage from ships in coastal waters. There is also a requirement for vessels to document within a Garbage Record Book all disposal and incineration operations, which can be used to account for how and where garbage is disposed of. There is a total ban on the disposal of plastics anywhere at sea.

In 2000 EC Directive 2000/59/EC on Port Reception Facilities for Ship-generated Waste and Cargo Residues was established. Under this Directive all member States must provide port collection facilities for waste; waste management plans are also required for all ports. Additionally under this Directive before ships can leave a Community port they are required to discharge their ship-generated waste unless they have an exemption, otherwise they can be detained. According to a study conducted in 2005 by EMSA this Directive has “raised awareness amongst ship operators, shipping agents, waste operators and environmental authorities of the environmental impact of illegal discharges into the sea” (OSPAR, 2009, p26). Furthermore, “the directive has led to an improvement of ship waste handling” (OSPAR, 2009, p26).

7.5.4. Oiled Birds

Birds are always the most visible victim of any oil pollution incident as they are found washed up along the effected coastline covered in oil. Oiled birds have been used in the Wadden Sea as a monitoring indicator for oil pollution for several years and are seen as a useful monitoring tool. Through this monitoring of oiled birds it has been recorded that “differences in oil rates between sea areas have clearly indicated that chronic oil pollution was more intense around shipping lanes than elsewhere” (Camphuysen *et al*, 2004, p115), furthermore there is also evidence that deliberate discharges from ships in

terms of bilge water containing fuel oils “are the main source of oil pollution” (Camphuysen *et al*, 2004, p116). However, “the number of dead oiled seabirds on the coastline is not in itself a reliable parameter for monitoring changes in oil pollution at sea” (Camphuysen *et al*, 2009 p2). Additionally despite the increased levels of oil pollution around the shipping lanes it has been stated that “there is little concrete information about the sources of oil pollution and other lipophilic in recent years” (Camphuysen *et al*, 2009, p4).

7.5.5. Discussion of State indicators

7.5.5.1. Tributyltin

TBT has been monitored in the Wadden Sea area for several years from five different sites and according to the 2009 QSR the levels of TBT experienced a reduction of between 80 and 90% in all areas. Geographically the highest levels of TBT in sediment occur in NL-West and Jade areas. This trend will probably continue especially at the Jade monitoring site due to the dredging of the channel for the new Jade-Weser container port which will disturb the sediment possibly causing TBT levels to rise (Bakker *et al*, 2009, p15).

7.5.5.2. Invasive species

The Wadden Sea ecosystem has several non-native species but many of those seen as invasive were introduced deliberately, this includes the Pacific Oyster, introduced by aquaculture, which has now spread throughout the Wadden Sea. Another important invasive species is the *Spartina* grasses which were introduced in the early 20th Century to help protect the coast, however the *Spartina* grass has mutated and can no longer be controlled. Both of these examples have intentionally been introduced by humans and have not come from ships ballast water transfer. However, the American razor clam *Ensis directus* has been introduced by ballast water and is quickly invading the whole coast. Effects of invasive species have been seen on the native populations so should be monitored carefully. Within the Wadden Sea 2009 Quality Status Report alien and invasive species are clearly defined and monitoring is in place.

7.5.5.3. Marine Litter

The 2009 QSR states that according to studies “shipping, the fisheries industry and offshore installations are the main source of litter found on German and Dutch beaches” however in the same section it also states that “identifying sources of marine litter is difficult as many types of items can come from multiple sources” (Fleet *et al*, 2009, p6). This view is further supported by an OSPAR report from 2009 which states that it is

“difficult to confirm how much litter actually is attributable to shipping” this report goes further and suggests that “efforts should be made to improve our knowledge” (OSPAR, 2009, p26) of this area. So even though shipping is seen as a major contributor to marine litter, the methodology used to gauge provenance is not yet sensitive enough to establish its real contribution and therefore it cannot be determined as the only source.

Marine litter is a persistent problem which affects the whole marine environment and poses a risk to several marine species which include seabirds and marine mammals. The OSPAR region has been monitoring levels of marine litter since 1998, therefore “a standardised protocol for collecting comparable measurements of beach litter within the OSPAR area” (OSPAR, 2009, p29) has been agreed. Throughout the North Sea area the amount of marine litter varies considerably and from an OSPAR Commission project which monitors marine litter it has been established that “significantly more items were found on beaches in the northern regions (northern North Sea and the Celtic Seas) than on the beaches on the Iberian coast and in the Southern North Sea” (UNEP, 2009, p108) which includes the Wadden Sea. From surveys carried out on four beaches in the Wadden Sea area between 2002 and 2008 it was found that on average there were 236 items of litter per 100 m (Fleet *et al*, 2009, p4).

A study on the amount of plastic particles found in the stomachs of Fulmars has also been used to establish trends in floating litter at sea as they only feed offshore. From a monitoring programme in the Netherlands it has been found that there has been “a significant reduction in plastic abundance from 1997 to 2006, mainly through a reduction in raw industrial plastics” (OSPAR QSR 2010 p118; also see 3.3.2.3).

7.5.5.4. Oiled Birds

Oiled birds have been used for several years as a tool for monitoring oil pollution levels in the Wadden Sea, from these studies it has been shown that throughout the Wadden Sea and its approaches “that oil rates have declined significantly over the last decade” (Camphuysen *et al*, 2009, p10). This view is supported by data from the OSPAR Commission, in their draft 2010 QSR they stated that “observations of oiled guillemots suggest that oil pollution at sea has been decreasing” (p6). It has been established that the oiled bird rate is higher along the North Sea coastline of the Islands than on the landward side of them. Furthermore it has been stated by Camphuysen *et al*. in the 2009 QSR, Oil pollution and Seabirds report, that “the effect of the designation of the PSSA Wadden Sea in 2002 is unclear, for within the Wadden Sea, oil rates have always been

lower than along the North Sea Coasts” (p10). The decline of oiled bird rates observed in the Wadden Sea area is mirrored across European waters.

7.6 Response indicators

The key response indicators from the PSR were the development of APMs, communication to mariners, co-ordination between States, oil spill response and stakeholder awareness.

7.6.1. Development of APMs

The development of APMs is an important part of the PSSA designation as the PSSA itself is not legally binding; it is the APMs which have a legal framework, being implemented through other existing Conventions such as MARPOL. Under the Resolution A.982 (24) 1.2, APMs are used to address the vulnerability to international shipping, so if additional APMs are required as existing measures are inadequate then the APMs should be developed further. The Wadden Sea and adjacent the North Sea was already subject to “...an extensive regime of protective measures prior to designation, consisting of both international and national regulations, aimed at reducing the impacts from and risks related to shipping. Examples of relevant measures are the MARPOL Special Areas against discharge of oil and garbage, routeing systems and making certain shipping routes compulsory for ships carrying hazardous goods and compulsory reporting for ships.” (Wadden Sea PSSA, 2002, MEPC 48)

The German Bight TSS and the Deep Water Route, both of which are routeing measures to reduce risk from shipping, are located outside the boundaries of the PSSA which under the Guidelines is allowed. However this does mean that there are currently no APMs within the PSSA itself which raises issues of appropriateness. If no additional protection is required what is the purpose of the designation?

7.6.2. Communication to Mariners

Mariners are key stakeholders within the marine environment, they are also the stakeholders with the greatest ability to protect the environment; therefore it is essential that when establishing an environmental measure such as a PSSA they must be informed about the area that has been designated. This information should include the nature of why it is important to be extra vigilant and how it will affect them from an operational perspective. If mariners have no understanding, education or knowledge as

to the locations and function of a PSSA, how are they expected to exercise additional caution when transiting the area?

Promulgation of information pertaining to PSSAs is most commonly through Marine Guidance Notices, Pilot books, Sailing Directions and nautical charts (paper and electronic) of appropriate authorities. At present there is no requirement under STCW '95⁴³ for mariners to receive any formal environmental education⁴⁴. A questionnaire was undertaken as part of the project where one of the main target groups was mariners. The results indicated that whilst many mariners had heard of the concept of PSSAs they did not know what it is for, or how it is marked on nautical charts.

7.6.3. Co-ordination between States

Co-ordination between States is particularly important for the Wadden Sea PSSA due to the trilateral nature of the designation. Where there are multiple interests and the potential for conflict there is a need for clear lines of communication and co-operation, in order to develop clear policies and goals that are equitable to all parties. Co-ordination and co-operation already exists between the States through a variety of instruments and agreements which provides a solid foundation for future work.

7.6.4. Oil Spill Response

In the event of an incident involving oil at sea the response method and co-ordination for any country is important as the faster and more efficient the initial response the less damage that should be caused in the long term. This is especially true for the Wadden Sea as the ecosystem of mud flats does not fare well with oil, therefore having an efficient and well-rehearsed response plan is essential.

The Wadden Sea countries have had bilateral agreements with each other for several years concerning emergency response actions in the event of an oil spill (DenGer and NethGer). A new agreement has been established called the DenGerNeth Plan, which will replace the already existing and operating bilateral response plans. DenGerNeth is a joint plan between Denmark, Germany and the Netherlands to deal with pollution in the event of an accident. This allows for any of the three States to ask for assistance if

⁴³ International Convention on Standards of Training, Certification and Watch-keeping (1995 amendments)

⁴⁴ The Manila Amendments to STCW include the requirement for environmental education (in force January 2012)

required. Two quick response zones have also been established and within these zones action must be taken immediately; as such each State has the right to first response even if the accident occurs outside their National Response Zone. However this agreement has yet to be ratified by the German and Dutch Governments. The Tri-lateral States are also all party to the Bonn Agreement carrying out both aerial surveillance and remote sensing to detect and combat pollution at sea.

7.6.5. Stakeholder Awareness

Stakeholder awareness is a key issue within the PSSA concept, as all the stakeholders need to understand and support the concept in order for it to be effective. Stakeholders are all those with a vested interest in the area and includes not only mariners and those whose livelihoods depend on the sea, but also others such as tourism agencies, national protection agencies and conservation NGOs. With respect to the Wadden Sea area where there are so many stakeholders and where due to its unique nature it has been classified as a World Heritage Site, it is imperative that all stakeholders are aware of the importance of preserving and conserving the area. The Wadden Sea PSSA currently excludes all of the major shipping lanes, and the vast majority of the designated area is between the mainland and fringing islands, which is not used by international traffic as it is too shallow.

7.6.6. Discussion of Response Indicators

7.6.6.1 Development of APM's

At the time of designation of the Wadden Sea PSSA, no additional APMs were proposed as there were already several international and national measures in place, including a traffic separation scheme and a deep water route. These routeing measures are adjacent to the PSSA and do not fall within the present PSSA boundaries. As previously discussed, a PSSA in itself is not a legally binding instrument; it is the APMs which have a legal basis and give the area the protection⁴⁵. The approach channels to the ports in the area were also excluded from the original designation. From evaluation and analysis of existing data it is evident that the area between the Wadden Sea islands and the inner TSS is an area that is vulnerable to shipping and that even after the designation of the PSSA it experiences a higher level of shipping incidents and

⁴⁵ Resolution 982 (24) para 1.2 : At the time of designation of a PSSA, an associated protective measure, which meets the requirements of the appropriate *legal instrument* establishing such measure, must have been approved or adopted by IMO to prevent, reduce, or eliminate the threat or identified vulnerability.

accidents than is desirable or acceptable for an ecologically and environmentally sensitive area (Figure 6).

The development of offshore installations to the north of the inner TSS (Figure 7) will place additional pressures with regard to navigation within the area, particularly in those areas where construction traffic has to cross the TSS. Additionally ships approaching and leaving the Ems River ports are required to cross the inner TSS and must pass between existing offshore installations (Dutch) and an installation in the construction phase (German); in addition a number of wind farms are planned for this area.

A substantial area of the PSSA, particularly to the south of the Elbe/Weser approaches is contained within fringing islands and is not navigable by international traffic. From data received it is evident that incidents do occur in these areas and additional protection could be afforded through Coastal States and their rights as proscribed within United Nations Convention on the Law of the Sea (UNCLOS)⁴⁶.

7.6.6.2. Communication to mariner's

Currently the UK Hydrographic Office (UKHO) does not include the Wadden Sea PSSA on the main paper charts for the area 1408 and 1423, however it does appear on chart 3766 (approaches to Esbjerg). The BSH identifies the PSSA on its routing chart only. All Dutch and Danish charts have the PSSA delineated (pers comm. Huisman & Poulsen, August 2009). From communications with the UKHO it was found that they 'pick them up from the Foreign Government charts' and that 'each case of PSSA is looked at on an individual basis' (Pers comm. Gibbons, October 2009). This suggests that as the PSSA is not marked on the BSH paper charts it will not be placed on the UKHO charts as they use BSH charts for information. The PSSA is identified on electronic charts of the countries⁴⁷, however not all ships have access to electronic portfolios and there is still a requirement for paper charts to be carried.

Under section 9.1 of Resolution A.982(24) it is only the APMs which have to be marked onto a chart, as it stated that "when a PSSA receives final designation, all associated protective measures should be identified on charts in accordance with the

⁴⁶ E.g. By entering foreign ports and other internal waters ships are within the territorial jurisdiction of the coastal State. Therefore pursuant of Article 211(3) coastal States may establish particular requirements for the prevention, reduction and control of pollution as a condition for the entry of foreign vessels to their ports

⁴⁷ However not on UKHO Ecdis (North Europe, Folio 5)

symbols and methods of the International Hydrographic Organization (IHO)” (Resolution A.982(24), 2005, p13).

Furthermore from the questionnaire none of the mariners/professional seafarers identified the Wadden Sea as a PSSA which raises the issue of the level of communication regarding the designation of the PSSA to the shipping industry as a whole.

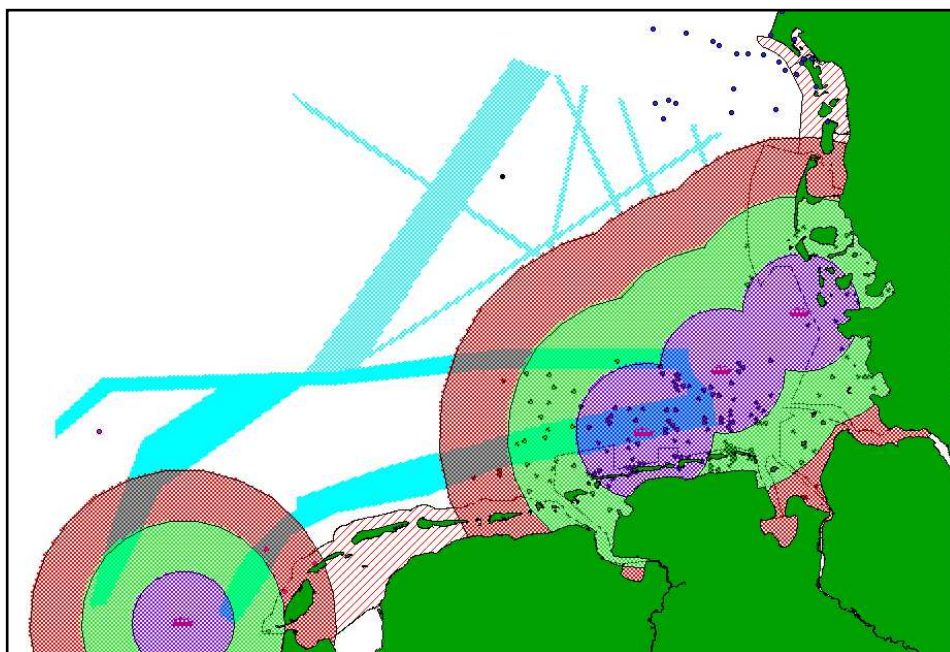
7.6.6.3. Co-ordination between States

This Tri-lateral designation is clearly working and the States involved are communicating well, this is demonstrated through the key trilateral policies which apply to the whole area as well as the production of the Quality Status Report every four to five years. However, the current monitoring techniques vary between each State which makes data difficult to compare, so data collection methods should be brought into line with each other to produce a unified and coherent data sets (see 7.2.1.1. & 7.2.11.2). The three States are also Contracting Party's of the Bonn Agreement, which aims to reduce marine pollution in the North Sea, under this the parties have to work together to combat pollution issues. One way is through the use of aerial surveillance which is undertaken by every North Sea State.

7.6.6.4. Oil spill response

There are clear plans in place for dealing with emergency response to oil spills in the Wadden Sea Area. There are 3 ETVs located within German waters and 1 available in Dutch waters. Denmark does not have a dedicated ETV; however they do have arrangements in place for chartering a vessel in the case of emergencies. The location of these ETVs and distance circles to represent response times were applied to the GIS model (figure 9). From this it was identified that there is a substantial area of the southern Wadden Sea that is not covered, even after a 3 hour response period, this area is located to the west of the German/Dutch border. It must be noted that not all of the ETVs are on station at their designated location at all times.

Figure 9. Location of ETVs indicating response time coverage of Wadden Sea area

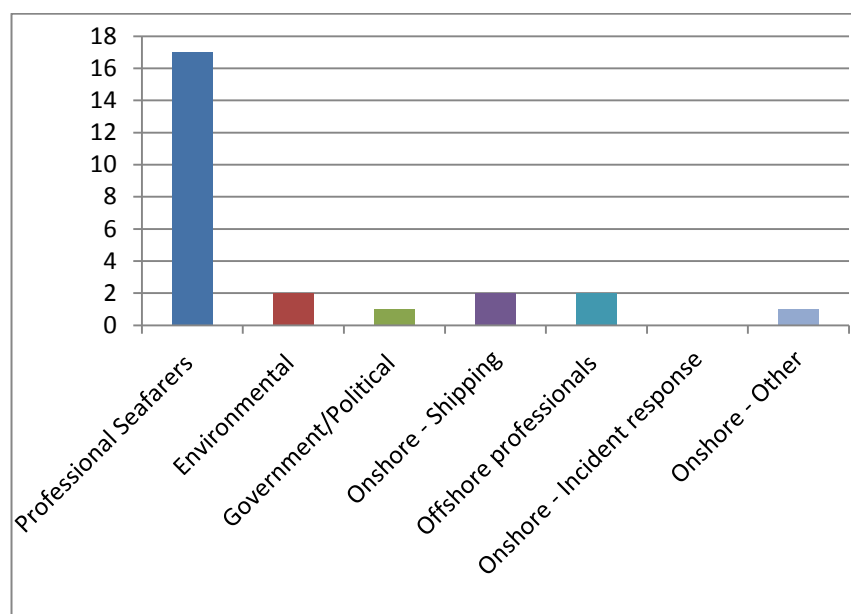


Key: Purple circle – 1 hour response zone, Green circle –2 hour response zone, Red circle –3 hour response zone

7.6.6.5. Stakeholders awareness

Amongst stakeholders it was clear that the level of awareness and knowledge is insufficient, particularly amongst professional seafarers (Figure 10). From the questionnaire it was found that although 71% of stakeholders had heard of a PSSA, when asked for specific details about the function and purpose of a PSSA, it was evident that they had very limited knowledge beyond having heard of the name.

Figure 10. Stakeholder respondents by job category who had not heard of a PSSA



Literature written about the Wadden Sea PSSA has stated that “the PSSA Wadden Sea designation will send strong signals to the international shipping community and increase awareness of the particular sensitivity of the area to impacts from shipping, such as oil” (Camphuysen *et al*, 2004, p116). But this is clearly not the case, from the 88 stakeholders asked only 12% (7) of the stakeholders were well informed and knew that a PSSA is to ‘protect an area which is vulnerable to international shipping and which is recognised for its environmental, or scientific or socio-economic importance’. Of these seven stakeholders only one of them was a professional seafarer. Also, when asked the location of designated PSSAs only stakeholders who lived in the Wadden Sea region identified it as a PSSA. Of the 32 Wadden Sea residents only 18 of them knew that it was a designated PSSA.

The Wadden Sea PSSA is currently not marked on either the UKHO or BSH paper charts for this area, with the exception of routeing charts. When the stakeholders were asked how a PSSA was marked on a nautical chart only four identified the symbol correctly, for most of the land based stakeholders this is of limited importance, however for the local pilots, commercial fishermen and professional seafarers this should be seen as being of great concern.

7.7. Findings of the Wadden Sea PSSA risk assessment

The main purpose of the risk assessment undertaken was to identify whether the PSSA was functioning effectively and to identify any gaps in implementation of available measures to protect the Wadden Sea from pollution associated with shipping and other maritime activities. The findings can be divided into three main sections firstly, shipping and regulatory control relating to shipping; secondly, stakeholder awareness, and thirdly, collaboration, monitoring and assessment of the PSSA. These are discussed in the following sections with regard to the Wadden Sea PSSA.

7.7.1. Shipping and regulatory control

At the time of designation of the Wadden Sea PSSA the associated protective measures (APMs) included a mandatory Deep Water route and the inner traffic separation scheme (TSS), both of which had already been established by the IMO prior to the designation. These APMs are adjacent to the PSSA and do not fall within the PSSA boundaries. The issue here is that a PSSA in itself is not a legally binding instrument; it is the APMs which have a legal basis and thereby give the area protection. Furthermore the approach

channels to the ports in the Wadden Sea area were also excluded from the original designation.

From evaluation and analysis of existing data it is evident that the area between the Wadden Sea islands and the inner TSS is an area that is vulnerable to shipping and that even after the designation of the PSSA it experiences a higher level of shipping incidents and accidents than is desirable or acceptable for an ecologically and environmentally sensitive area. This situation is likely to be exacerbated by the development of offshore wind parks to the north of the inner TSS, which will place additional pressures with regard to navigation within the area, particularly in those areas where construction traffic has to cross the TSS. Additionally ships approaching and leaving the Ems River ports are required to cross the inner TSS and must pass between an existing offshore installation in the Dutch sector and an installation in the construction phase in the German sector (Figure 7, p79); an additional two wind farms are also in the planning stage for this area.

Traffic separation schemes exist in many areas of high vessel traffic around the world in order to help prevent collisions and accidents. However the majority of mariners will not associate a TSS as an associated protective measure (APM) to help protect an environmentally and ecologically vulnerable area such as a PSSA; rather as a routing measure that must be complied with. This was evident from the findings of the stakeholder questionnaire where mariners' knowledge of PSSAs was limited.

7.7.1.1. Increase in shipping

It is important to take into account the volume of international shipping passing adjacent to the PSSA and to ports within the Wadden Sea area, which has increased year on year since the designation of the PSSA. The opening of the new Jade-Weser container terminal will also see a significant increase in larger and deeper drafted vessels through the area and approaches. Whilst there is mandatory pilotage for some vessels through the approach channels to the ports, there was evidence that some of the pilots operating within the area are unclear or unsure about the PSSA designation.

7.7.1.2. Vulnerability

The recent successful nomination of the Wadden Sea as a World Heritage Site further highlights the need for any vulnerability from shipping to be addressed in order to offer the highest level of protection possible to the area.

7.7.2. Stakeholder awareness

Stakeholders should be considered as potential advocates of PSSAs as they include everyone who has a vested interest in the area as well as those whose livelihoods depend on the sea. From the findings of the stakeholder questionnaire undertaken it was clear that the level of awareness of the purpose of a PSSA varied dramatically. Whilst many people had heard of the term, knowledge of the actual purpose and location of the PSSA was poor. Whilst some stakeholders who live in the Wadden Sea area were aware of PSSAs, many were not aware that they lived beside or worked in one.

The results that were of most concern were those relating to professional mariners and local pilots, who out of all stakeholders should have known about PSSAs, as they are an IMO instrument. Furthermore PSSAs should be clearly identified on hydrographic charts utilised by seafarers. The findings revealed that the Wadden Sea PSSA is not uniformly identified on all nautical charts, the reason for which is not totally clear; however the fact that large areas of the currently designated area are not navigable by international shipping, due to available depth of water in the near coastal zone, may provide a potential explanation.

7.7.3. Collaboration, monitoring and assessment

7.7.3.1. Collaboration

Collaboration amongst coastal states is of the utmost importance with regard to developing a comprehensive and cohesive management framework. Since the establishment of the Common Wadden Sea Secretariat (CWSS) in 1987 there is evidence of good dialogue between all States, however there is a need to progress towards a more effective management strategy that encompasses practices similar to those undertaken by the Great Barrier Reef Marine Park Authority and within the Helcom Baltic Sea Action Plan. The ability to work within a common framework enables a more proactive and cohesive approach to be undertaken. This strategy would help to avoid duplication of tasks and the possibility of misrepresentation or misinformation. By extending co-operation and collaboration and working within a common framework, the opportunity will arise to develop and undertake a common risk analysis for the Wadden Sea PSSA in order to determine and instigate common response measures.

7.7.3.2. Monitoring and assessment

Whilst monitoring of the Wadden Sea has been undertaken for many years, the focus has been on ecological and environmental indicators. This type of monitoring whilst of great importance with respect to the PSSA fails to encompass several key elements, particularly with respect to shipping specific data. Additionally there are issues with respect to lack of continuity, quality and collaborative exchange of data that is currently collected.

Environmental and ecological data for the Wadden Sea area has been collected in some cases since the late 1960s. However a common methodology has not always been employed by the three Wadden Sea States and therefore data has had to be normalised in order to be included within the Tri-lateral Monitoring and Assessment Programme (TMAP) and the Quality Status Reports (QSR). The type, collection, interpretation and sharing of collected data needs to be brought into line with a common framework that will enable a more cohesive and effective monitoring programme to be established.

The current TMAP data collection model includes no shipping related parameters, as identified within the evaluation indicator suite (section 2.2.5). The inclusion of this data would enable a more detailed analysis and identification of areas within the PSSA that were at greatest risk from shipping activity. It is suggested that the existing TMAP programme could be modified to include additional indicators that pertain directly to shipping, to assist with future monitoring and evaluation of the PSSA. This aligns with the desirability for a common risk analysis and common framework to be instigated for the Wadden Sea PSSA. The pressure, state, response framework provides a guide to future monitoring measures that may be adopted for further evaluation. These may include a more robust collection of current data, the generation of new indicators and a clearer connection between maritime activity and environmental quality.

The sampling locations used for collection of data utilised for the Quality Status Report (QSR) are distributed around the Wadden Sea, but there are limited sites within the shipping lanes of the estuaries. In order to assist with effective monitoring of the PSSA sampling sites should include areas within both the shipping lanes and the seaward side of the islands to enable identification of shipping related impacts to be measured in addition to those relating to land based sources and river inputs.

The findings of the evaluation highlighted that monitoring and reporting of shipping accidents, incidents and near misses in the Wadden Sea PSSA needs to be addressed. At present there is no central database or unified reporting system and current reporting procedures vary greatly, both qualitatively and quantitatively.

7.7.4. Effectiveness of the Wadden Sea PSSA

The findings of the evaluation were inconclusive and provided no clear evidence that the PSSA designation was effective with regard to protection of the marine environment from shipping. However it did provide clear evidence as to where further effort should be made and also highlighted short comings with regard to monitoring and assessment, particularly relating to collection of appropriate data with a clear shipping signal and the need for a uniform approach to be taken by all three Wadden Sea States.

CHAPTER 8

APPLICATION OF GOOD PRACTICE FROM INTERNATIONAL AND REGIONAL ENVIRONMENTAL PROTECTION AGREEMENTS

8.0 Introduction

This chapter reflects on the findings of the evaluation of the Wadden Sea PSSA in order to meet objective 5 - Propose ways in which Particularly Sensitive Sea Areas designations can be enhanced in order to provide more effective protection to the marine environment. This discussion is expanded to the wider context of other environmental protection mechanisms and how they are implemented, monitored and assessed as discussed in Chapters 4 and 5, in order to identify why PSSAs may not be functioning to their full potential and how this may be addressed.

8.1 Issues and lessons learnt from the Wadden Sea evaluation

The findings of the Wadden Sea evaluation were somewhat inconclusive. Whilst it was evident that the Wadden Sea was in a healthy state and some improvements had occurred, it was not possible to say whether the actual designation had been responsible for the improvement or whether other elements, such as changes in IMO or EU legislation were responsible. However it did highlight potential issues relating to future developments within the area⁴⁸ and how these may impact on the area in relation to shipping and the marine environment. Furthermore it identified areas where greater effort should take place in future in order to achieve the greatest benefit of the designation. This was discussed further at a workshop of major stakeholders of the Wadden Sea, held in Hamburg in May 2011, where the results of the evaluation were presented and key findings specifically relating to risk management and raising awareness were discussed (Butt & Wright, 2011).

8.2 Data, monitoring and assessment

One of the major issues identified during the evaluation of the Wadden Sea PSSA related specifically to availability and collection of appropriate data (i.e. data with a specific shipping signal). This was compounded by a lack of continuity within data sets that were available. Furthermore whilst data was available through the Trilateral Monitoring and Assessment Programme (TMAP), the type of data collected related to a

⁴⁸ Such as offshore wind farms and the expansion of some Wadden sea ports with associated increases maritime traffic

more traditional style of monitoring (see section 5.3), where data is collected to measure a specific issue in order to evaluate performance against targets set by national or international policy e.g. *inter alia* Water Framework Directive; Wild Bird Directive, Habitats Directive, Ospar Convention. This type of data, whilst demonstrating compliance with policy, and enabling trends to be observed does not enable a complete assessment of the whole area to be undertaken, nor does it give the opportunity to examine why change has occurred. It is suggested that without the collection of appropriate and accurate data, any effort to evaluate effectiveness of a protective mechanism is limited.

The need to ensure that appropriate indicator data is collected was demonstrated clearly during the evaluation of the Wadden Sea. Whilst the tri-lateral states of the Wadden Sea area have been collecting environmental and ecological data for many years, through the TMAP; the efficacy of this data is questionable, particularly when trying to assess the relationship between and associated impacts of shipping to the marine environment. Primarily due to the fact that the TMAP programme was originally designed to assess ecological and general environmental state that was of relevance to requirements identified through various national and international agreements, rather than to measure impacts from shipping and maritime activities.

Within the evaluation, data collected and available which related to shipping appeared to be on a somewhat *ad hoc* basis, which meant that the quality and accuracy of data pertaining to shipping accidents and incidents lacked uniformity which created additional issues, particularly when inputting data within the GIS mapping exercise to identify areas that could be said to be at particular risk, and which would benefit from specific or enhanced management. The introduction of the Third Maritime Safety Package, in particular Directive 2009/17/EC, sets out to improve issues relating to collection and transfer of data between EU countries by creating a network for information exchange. It is presumed that when this is fully functioning that data will be collected in a standardised format. Likewise Directive 2005/35/EC relating to penalties for ship-source pollution would imply that closer monitoring and accurate record keeping will be needed in order to apply penalties.

Cross sectoral issues and lack of an integrated approach to management of the marine environment will invariably lead to a fragmented approach to collection of data

irrespective of whether a PSSA belongs to a single or multiple countries. It is suggested that one method of ensuring that appropriate data is collected could be achieved is through the development of management plans for proposed PSSAs prior to submission of a designation proposal.

8.3. Management and Evaluation

Currently there are no requirements within the PSSA guidelines for management, monitoring or assessment to be put in place at the time of designation (Roberts 2009, pers.comm). This is in contrast to virtually every other environmental protection measure discussed in Chapter 4. Furthermore the reasons for and benefits of such an approach are identified as elemental by Carleton Ray (1999), Rusken-Cohen & Christman (2004) and Hardman-Mountford *et al.* (2005).

For example, there is very clear direction under the Conditions of Integrity (section II.E:87-95) and Protection and Management (section II.F: 96-119) of the operational guidelines for World Heritage Sites that appropriate management plans should include monitoring on a regular basis that corresponds to appropriate ecological, temporal and spatial variables (UNESCO, 2008). The German and Dutch sectors of the Wadden Sea have recently received World Site designation, and the Danish sector have submitted a proposal that the site be extended to include their waters within the designation, there is a clear opportunity to address the issue of appropriate assessment and monitoring of the Wadden Sea PSSA in conjunction with meeting the requirements for a designated World Heritage site. Particularly as a key recommendation for World Heritage Sites where shipping occurs near or through a site identifies PSSAs as an appropriate additional protective mechanism.

The use of an Eco-system approach to management, based on scientific information would enable the identification of appropriate data to be collected, it would also meet the requirements of the CBD. However as discussed in Chapter 5, there are issues with this approach, due to the many stakeholders and multiple inputs within the marine environment. Within the UNEP Regional Seas Programme where management is based on Large Marine Ecosystems and where there are multiple stakeholders and inputs, assessment is through the use of condition indicators with management plans being designed and implemented based on the indicators (NOAA, n.d). This approach aligns with the use of the PSR framework for the Wadden Sea evaluation, where

identification of specific indicators were targeted, based on a clear rationale. This approach enables adaptation that can account for geographical, temporal and spatial changes. Furthermore the development and use of the PSR framework could also be used from the start of the designation process, in order to help assess the area and to identify appropriate APMs for protecting a PSSA.

The potential and benefits of utilising the designation process of a PSSA as an opportunity to undertake a comprehensive evaluation was noted by Johnson (in Roberts, 2007 p 174), during the preparation of the proposal documents for designation of the Florida Keys in 2005. Additionally the potential for a PSSA to be utilised as a comprehensive management tool is identified as a key concept by Roberts (2007 p174), this is further iterated by opinions obtained from the experts contacted during the Wadden Sea evaluation project (Johnson, Makinen, Patry and Roberts, 2009, pers.comm).

This research suggests that undertaking a holistic evaluation at the proposal stage, could form the baseline for data collection of carefully selected indicators, thereby enabling a benchmark to be set, against which future data could be assessed. A further step which could be taken is the greater use of co-operation between instruments and conventions. A good example being the work done by Ramsar with respect to Multilateral Environmental Agreements (MEA), where they actively seek to develop synergies with other environmental instruments, thereby reducing duplication of effort and also enabling greater transparency across all sectors and amongst all stakeholders. Furthermore this approach also aligns well with the principles of Coastal Zone Management identified by Cicin-Sain and Thai-Eng (1993), where integration is seen as a key tool for reducing stakeholder conflict, harmonising management processes and engendering public support. As several protective mechanisms exist within the Wadden Sea area there should be ample scope to develop MEAs.

The concept and importance of management, assessment and monitoring is a recurring theme across many of the major environmental protection instruments and one that the many of the experts contacted for the Wadden Sea evaluation highlighted as an issue. It is further noted that a commonality amongst the expert opinion was that in order for a PSSA designation to be effective then management, assessment and monitoring were essential requirements, and that the inclusion of management plans and a process of

assessment and monitoring should in fact form a part of the application for designation of an area as a PSSA. Table 8 identifies opinions from some of the experts to support this argument.

Table 8. Quotes from experts relating to management, monitoring and assessment

Simon Walmsley	Protection needs to be highlighted via a decent management and implementation plan. The PSSA tool should be a living and adaptive form of management with monitoring both before and after designation to ensure the right level of protection is being afforded
Julian Roberts	There is a need for a more risk based approach to designation of PSSAs. Future PSSAs should include implementation and management plans to allow for on-going monitoring and reporting.....measures require rigorous monitoring to assess their effectiveness, there is no requirement from the IMO for this to take place. Increased monitoring and reporting are not part of the PSSA proposal
Anita Makinen	A legally binding monitoring processafter establishment of a PSSA should be demanded as should reporting of shipping incidents and near misses
Sian Prior	PSSAs should undergo a review process. There is a need to establish changes within the area and to respond to these changes. A process needs to be in place to ensure APMs are doing their job

Effective management is seen as an essential element within the CBD Programme of Work (Dudley *et al*, 2005), which contains guidelines, tools and resources for successful protection and management and which also addresses Regional, National and International interests. Additionally it encompasses not only policy makers but also local communities thereby iterating the need to ensure engagement in the process and capacity building of all stakeholders in order to create an effective protection mechanism.

8.4 Stakeholder awareness

The findings in relation to lack of awareness amongst stakeholders and promulgation of information pertaining to the PSSA, particularly to mariners, was of significance, and was highlighted by the majority of the experts as being an imperative requirement to the effectiveness of a designation (Table 9) . Whilst the research findings indicated that 71% of respondents had heard of a PSSA, it is suggested that awareness was linked to the term ‘PSSA’ only, as evidence of knowledge of their purpose was extremely limited. This clearly sends a signal that capacity building across stakeholders, particularly mariners, requires substantial additional effort.

Stakeholder involvement and awareness provide the foundations and underpin much of the work of successful environmental management and protection. Within an IUCN Marine Protected Area (MPA) the success of the designation would appear to be directly linked to the ‘buy in’ of stakeholders, through capacity building. Wherever possible stakeholders are given the tools through education programmes to manage, monitor and assess the MPA by themselves. The concept of stakeholder awareness and involvement are also key to the roles identified for biosphere reserves where conservation, development and logistics are seen as complementary and not mutually exclusive, but all of which rely on stakeholder involvement to avoid conflict (UNESCO, 2010b). Furthermore successful application of Marine Spatial Planning, which has many attributes that could be applied to PSSAs in order to enhance their effectiveness, also identifies that stakeholder engagement is critical (Gilliland & Laffoley, 2008, Ehler & Douvere, 2009)

Table 9. Quotes from experts on awareness

Anita Makinen	Fishermen, tourism industry and seafarers must be better informed of purpose in order to understand benefits and how to follow regulations.... public awareness raising after establishment of a PSSA should be demanded... Sea fearers should also be informed in a better way to make them understand the benefitting values of PSSA and also to make them understand how to monitor its regulations.
Sian Prior	It is better than it was, but I feel that many stakeholders are not well-briefed. Frequently they don't know what a PSSA is, what measures it conveys (or doesn't), and what is possible. Many still confuse PSSA and Special Area.
Hans Rosner	My impression is, that the stakeholders in the shipping sector are very poorly informed on the PSSA, and as long as there is no need for them to be informed ...this can hardly be changed.
Julian Robertscrucially mariners are poorly informed
Sian Prior	Although better than it was, many still confuse PSSA with Special area
Lindy Johnson	there is a great deal of work that must be done domestically to inform stakeholders of the benefits of PSSA designation.... it is up to the proposing State(s) to do this necessary work before submitting a PSSA proposal. Mariners should be adequately and appropriately informedshould be aware of how to comply with them (<i>APMs</i>).
Sjon Huisman	I learnt (and found it disturbing) that within the large field of authorities, there are many employees that do not have an idea what PSSA stands for. Not only in words but also in practice.

To try and establish the extent of the issue and to reinforce the findings of the experts and the evaluation, an additional piece of research was undertaken, which focused specifically on mariners. This research comprised a simple questionnaire designed to identify the level of awareness of seafarers to marine environmental protection mechanisms, and was posted on the internet using 'SurveyMonkey™'. Details of the site were promulgated to various training establishments around the world and also to seafarers known to the author, who in turn passed the link on to their shipmates. In total 161 responses were received, representing 10 different nationalities. The findings indicated that whilst awareness of MARPOL and associated Special Areas was good (80%) there was a low level of awareness of PSSAs (22%). The findings of this research and issues associated with environmental education of mariners were presented at the 1st World Ocean Council Congress in Belfast in June 2010 (Butt, 2010).

CHAPTER 9

CONCLUSION AND RECOMMENDATIONS

9.0 Conclusion

The need for protecting the oceans and seas specifically from the impact of ship borne pollution was first identified in 1954. As environmental protection rose on the International agenda after being recognised as an imperative for sustainability of the planet, both in the terrestrial and marine environment, legislation at International, Regional and National levels has been developed and implemented in order to protect and conserve the environment. In response to these changes the work undertaken by the IMO has also adapted and their remit has broadened to encompass not only safety of shipping and navigation but also protection of the environment. Initially the focus was on protection of areas from a specific form of pollution, which fell under a MARPOL Annex, through the designation of Special Areas. However a more targeted approach to protection of areas that are vulnerable and which experience the greatest threat from shipping, be it through volume or type of vessel or particular sensitivity of an area, led to the recognition by the IMO that a new designation was required that could enable a State or States to incorporate measures to address these wider shipping related threats, thereby protecting the most sensitive marine environments, through designation of a Particularly Sensitive Sea Areas which could provide a sectoral complement to other designations intended to protect the marine environment and to conserve marine biodiversity.

The development of PSSAs took place over an extended period of time – from initial identification of the need for such a protective mechanism in 1978 to the adoption of the first set of guidelines in 1991. A constant process of review was required to address issues within the guidelines, which resulted in a series of amendments. Key issues related to confusion caused by the fact that initially designation of MARPOL Special Areas and identification of PSSAs were contained within a single document until being separated into their own Annex in 2001. Furthermore, the criteria used for qualification and the wording within the documents caused many to confuse the two designations or to use the identification of PSSAs inappropriately, particularly as the issue of demonstrating vulnerability was not clear cut.

Throughout the process of development and as amendments were being made to the guidelines, there was no requirement for a complete assessment of the area and

monitoring to be put in place either at conception or when the designation was in place. By not putting in place a requirement for comprehensive management plans that would enable a State or States to respond to changes in vulnerability from international shipping activities, the IMO reduced the ability of designation as a PSSA to function to its full potential as a protective mechanism.

The review of international, regional and national agreements and conventions relating to environmental protection identified a commonality for adopting a sustainable approach, the need to monitor and assess an area and the need for management plans to be implemented. Furthermore, the use of multi-lateral environmental agreements in order to ensure limited overlap of effort and a more ‘joined up’ approach to management of an area is commonplace, thereby reducing potential areas of conflict in multi-stakeholder areas. There is also a clear focus on capacity building as a foundation for success that helps reduce conflict, encourages engagement and engenders ‘ownership’ amongst stakeholders.

The benefits of assessment and monitoring allow for adaptive management and the ability to respond to changes at the earliest opportunity. Within the marine environment use of marine spatial planning allows for a more integrated approach which encourages horizontal and vertical integration as well as enabling cross sectoral conflicts to be addressed. This adaptive approach addresses many of the issues that are experienced within a designated PSSA and it is suggested that lessons can be learnt from the approach that would be of benefit to Member States of the IMO when it comes to protection of the marine environment.

The evaluation of the Wadden Sea highlighted many issues which link in with the findings of this research. Key areas of concern being the lack of any baseline data from when the designation was made, the poor quality of existing data sets, particularly for data with a specific shipping signal, the very poor level of awareness of the function and purpose of a PSSA designation amongst stakeholders, particularly mariners and those whose livelihood depends on the sea. Additionally the lack of any APM being directly attached to the designation raises questions as to whether the designation in itself added any additional protection to the area, particularly as the APMs are the only elements of the designation with a legal basis.

It would appear evident that the identification and designation of an area as a PSSA is not necessarily in itself an effective mechanism for protecting the marine environment. Whilst it has the backing of the IMO, there are shortcomings that need to be addressed if the designation is to have any ‘teeth’. If the only legal element of the designation is an Associated Protective Measure (APM) – how can a designation without any APMs within its delineation, or a clearly identified buffer zone, function as a protective mechanism? Likewise if the information is not promulgated about the specific purpose of a PSSA – particularly to key stakeholders such as mariners, how can they be effective? If no management plans exist and if the area is not monitored and assessed, how can action be taken to ensure that the designation is effective?

Clearly if the concept of PSSAs is to be advanced and in order for them to be accepted as an appropriate and effective means of protecting the marine environment from international shipping there is a need for the Marine Environmental Protection Committee to re-visit the guidelines in their current form and to make amendments that bring the designation in line with other international, regional and national agreements where management, monitoring and assessment form the cornerstones for effective protection of the environment.

9.1 Recommendations

The aim of this research was to establish whether Particularly Sensitive Sea Areas were effective as protective mechanism for the marine environment from international shipping activities. Based on the findings of the research and the case study undertaken of the Wadden Sea PSSA the following recommendations are made:

- In order to justify the designation of a PSSA there should be credible and clear evidence, supported by appropriate data, that the area is vulnerable to maritime activities, and that the identified vulnerabilities will be addressed by supporting Associated Protective Measures.
- Any APMs identified at the time of designation should be new measures and not a measure that is already in place.
- The designated PSSA should include all areas utilised by shipping (i.e. port approaches) or which is subject to maritime activity.

- The IMO should amend the current guidelines to insist that prior to designation proposal a risk analysis is undertaken and an appropriate assessment and management strategy is identified and included with the proposal.
- In order to facilitate monitoring and assessment, relevant indicators which have a specific shipping signal, should be identified from the findings of a risk analysis of the area and form an integral part of any proposal for designation. These would then form a baseline from which to monitor and assess the PSSA once designated.
- Selection of data pertaining to indicators and parameters for collection of this data for assessment and monitoring, should be consistent and should also be accessible to all stakeholders. Collaborative effort and continuity being of particular importance for multi-lateral proposals.
- A designation should not be for life. Every designated PSSA should provide evidence that the designation is still required and appropriate. It is suggested that a review of any designation should be undertaken by the State or States involved at least every three years. This would enable additional APMs to be identified and put in place to address any changes in vessel characteristics or use of the area such as offshore developments, should it be required.
- There is a need for greater effort and consistency with regard to promulgation of where PSSAs are and their function and purpose to the maritime community, this being of particular importance for seafarers. All charts, both paper and electronic, should clearly identify every PSSA and draw attention to the APMs in place.

10.0 Post script

Since the completion of this research the Marine Environmental Protection Committee (MEPC) of the IMO had a paper presented by WWF and IUCN (document MEPC65/9) which identified “....the need to periodically and thoroughly evaluate the effectiveness of Particularly Sensitive Sea Areas (PSSAs) and their Associated Protective Measures (APMs).....” (MEPC65/22, p61). It was suggested by WWF and IUCN that through undertaking an evaluation the effectiveness of protective mechanisms could be measured and adjustments made to address changes in risk, vessel traffic and usage of the area. Furthermore the document also proposed that all existing PSSAs should be reviewed and that there should be a requirement for all future PSSAs to undergo reviews after designation. This suggestion by WWF and IUCN is sound and would be beneficial both for current and future PSSAs and aligning with the findings of this research. The response to the WWF/IUCN submission from the MEPC was that the current Guidelines for the Identification and Designation of PSSAs, specifically paragraph 8.4 of Resolution A982 (24) (Appendix K) already includes a mechanism for such reviews.

*“IMO should provide a forum for the **review and re-evaluation of any associated protective measure adopted**, as necessary, taking into account pertinent comments, reports, and observations of the associated protective measures. Member Governments which have ships operating in the area measures to IMO so that any necessary adjustments may be made. Member Governments that originally submitted the application for designation with the associated protective measures, should also bring any concerns and proposals for additional measures or modifications to any associated protective measure or the PSSA itself to IMO.”* (Res A982(24) para. 8.4)

It would appear that as was the case within previous guidelines the way in which they are interpreted presents potential for confusion. The implication of para 8.4 is that only the APMs should be reviewed and re-evaluated. It does not suggest that in order to re-evaluate APMs the whole PSSA should be evaluated – which is essential in order to make a true judgement of whether the APMs have been effective. The findings of this research indicate that a more holistic approach is required which encompasses the whole PSSA or even extend beyond the boundaries of a PSSA.

At the same meeting the Australian delegation informed the committee of their intention to undertake an evaluation of the GBR World Heritage Area and the American delegation also indicated they would be undertaking evaluations of their 2 PSSAs. However the intention of both parties is to utilise the World Heritage Site Evaluation methodology, which whilst appropriate to some extent, may not present a complete picture as evaluation of the shipping element is not addressed within the World Heritage Site evaluation methodology. The ability to identify or extract a clear shipping signal from data was an issue faced during this research whilst evaluating the Wadden Sea PSSA and it was clear from the findings that the need for categorical shipping data is an imperative for the successful evaluation of a PSSA.

11.0 REFERENCES

- Bakker, J., G. Lüerßen, H. Marencic, K. Jung, (2009). Hazardous Substances. Thematic Report No 5. In: Marencic, H. & Vlas, J. de (Eds), 2009. *Quality Status Report 2009. WaddenSea Ecosystem No. 25*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.
- Brown, E. (1994). The International Law of the Sea, Volume II. Documents, Cases and Tables. Aldershot: Dartmouth.
- BSH, (2009). Directive on Spatial Planning in the German Exclusive Economic Zone of the North Sea [online].
Available: http://www.bsh.de/en/Marine_uses/Spatial_Planning_in_the_German_EEZ/documents/DraftEENorthSea_.pdf [accessed 6th October 2009]
- Butt, N. (2010). Sustainable Ocean Summit: Session 11. Environmental education and training for marine professionals. [online]. Available from: <http://www.oceancouncil.org/site/pdfs/11%20Mariner%20Education%203-Butt.pdf> [accessed 20 June 2011]
- Butt, N., & Wright, P. (2011). Trilateral Workshop on the Wadden Sea PSSA. [online] Available from: <http://www.waddensea-secretariat.org/news/symposia/PSSA-2011/PSSA-2011.html> [accessed 22 June 2011]
- Butt, N., Gallagher, A., Thatcher, K., Vigar, N., & Wright, P. (2010). An evaluation of the Wadden Sea Particularly Sensitive Sea Area. Common Wadden Sea Secretariat. CWSS.
- Camphuysen C.J., D.M. Fleet, B. Reineking and H. Skov, (2004). Oil Pollution and Seabirds. In: Essink, K., C. Dettmann, H. Farke, K. Laursen, G. Lüerßen, H. Marencic and W. Wiersinga (Eds), 2005. *Quality Status Report 2004. WaddenSea Ecosystem No. 19*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.
- Camphuysen, C.J., M. S. Dieckhoff, D. M. Fleet and K. Laursen,(2009). Oil Pollution and Seabirds Thematic Report No 5.3. In: Marencic, H. & Vlas, J. de (Eds), 2009. *Quality Status Report 2009. WaddenSea Ecosystem No. 25*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.
- Carellon Ray, G. (1999). Coastal marine protected areas: agonies of choice. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 9, 607 - 614.
- Cargo Systems, (2002). Top 100 Container Ports 2002. London: Informa Maritime and Transport.

Cassell, C., & Symon, G. (1994). Qualitative methods in organisational research: a practical guide. London: Sage.

CBD. (2000). COP 5 Decision: Ecosystem Approach. Accessed 2 August 2010. Available from: <http://www.cbd.int/decision/cop/?id=7148>

Chape, S. Spalding M.D., Jenkins M.D (Eds) . (2008). The World's protected areas: status, values and prospects in the 21st century. Berkeley, Los Angeles: University of California Press.

Cicin-Sain, B. (1993). Sustainable development and integrated coastal zone management. *Ocean & Coastal Management*, 21, 11-43.

Commission of the European Communities, (2007). Commission Staff Working document: *An Integrated Maritime Policy for the European Union* [online]. Available: http://ec.europa.eu/maritimeaffairs/pdf/ActionPaper/action_plan_en.pdf [accessed 7th December 2009]

Commission of the European Communities, (2008). Communication from the commission: *Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU* [online]. Available: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0791:FIN:EN:PDF> [accessed 7th December 2009]

ConocoPhillips, 2007a. Wilhelmshaven Refining for the Future. ConocoPhillips Spirit [online], 1, pp.22-27. Available from: http://www.conocophillips.com/EN/about/company_reports/spirit_mag/Documents/Spirit_1Q2007small.pdf [accessed 8th January 2010]

ConocoPhillips, 2007b. ConocoPhillips Key Assets, Operations and Locations [online]. Available from: http://www.nfwf.org/Content/ContentFolders/NationalFishandWildlifeFoundation/Programs/ConocoPhillipsSPIRITofConservation/2007_COP_ASSET_MAP.pdf [accessed 7th January 2010].

Cote, R. (1992). Marine Environmental management: Status and Prospects. *Marine Pollution Bulletin*, 25(1-4), 18-22.

Defra. (2009, March). DEFRA. Marine Environmental Research Programme.. [online]. Available from: <http://archive.defra.gov.uk/environment/marine/documents/science/research-review.pdf> [accessed 12 August 2011]

Detjen, M. (2006). The Western European PSSA - Testing a unique international concept to protect imperilled marine ecosystems. *Marine Policy*, 30, 442-453.

DeVellis, R. (2003). Scale development theory and applications: Applied social research methods series. (2nd Edition ed., Vol. 26). London: Sage.

Douve, F. (2008). The importance of marine spatial planning in advancing eco-system based sea use management. *Marine Policy*, 762 - 761.

Douve, F., & Ehler, C. (2009). New perspectives on sea management use: Initial findings from European experience with Marine Spatial Planning. *Journal of Environmental Management*, 90(1), 77-88.

Dudley N., Mulongoy K.J., Cohen S., Stolton S., Barber C.V. and Sarat S.B. (2005). Towards Effective Protected Area Systems. An Action Guide to Implement the Convention on Biological Diversity Programme of Work on Protected Areas. Secretariat of the Convention on Biological Diversity, Montreal, Technical Series no. 18

Ehler, C. (2008). Conclusions: Benefits, lessons learned and future challenges of Marine Spatial Planning. *Marine Policy*, 32(5), 840-843.

Ehler, C., & Douve, F. (2009). Marine Spatial Planning: A step by step approach toward eco-system based management. UNESCO, International Oceanographic Commission & Man and Biosphere Programme. Paris: UNESCO.

Europa, (2006). Maritime Safety: Prohibition of Organotin Compounds on Ships [online]. Available from: http://europa.eu/legislation_summaries/transport/waterborne_transport/124256_en.htm [accessed 23rd September 2009]

Europa, (2009). Maritime Safety: Ship-source and criminal penalties [online]. Available from: http://europa.eu/legislation_summaries/environment/water_protection_management/124123_en.htm [accessed 23rd September 2009]

European Commission, (2009a). 3rd Maritime Safety Package: Classification Societies [online]. Available from: http://ec.europa.eu/transport/maritime/safety/doc/2009_03_11_package_3/fiche02_en.pdf [accessed 23rd September 2009]

European Commission g, (2009b). 3rd Maritime Safety Package: Insurance of Shipowners for Maritime Claims [online]. Available from: http://ec.europa.eu/transport/maritime/safety/doc/2009_03_11_package_3/fiche07_en.pdf [accessed 23rd September 2009]

FAO (2012) Pressure-State-Response and Environmental indicators. [online] Available from: <http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/Refer/EnvIndi.htm#DSR>. [accessed 14 September 2012]

Federal Environment Agency (n.d.) *Umweltbundesamt*: Archive for retrospective monitoring [online]. Available from: <http://www.umweltbundesamt.de/specimen/upb71.htm> [accessed 20th November 2009]

Fleet, D., J., van Franeker, J., Dagevos and M. Hougee, 2009. Marine Litter. Thematic Report No 2.8. In: Marencic, H. & Vlas, J. de (Eds), 2009. *Quality Status Report 2009. WaddenSea Ecosystem No. 25*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.

Gare, N. (1976). Review of Progress in the Creation of Marine Parks and Reserves. Proceedings of an International Conference on Marine Parks and Reserves, (pp. 65 - 71). Tokyo.

Gibbons, N., (2009). Personal Communication. United Kingdom Hydrographic Office, 23rd October 2009.

Gilliland, P.M., Laffoley, D., (2008). Key elements and steps in the process of developing eco-system based marine spatial planning. *Marine Policy*. Vol 32:5 Septemebr. (787-796)

Gjerde, K. (1999). IMO Approves Protective Measures for Cuba's Particularly Sensitive Sea Area in the Sabana-Camaguey Archipelago. *International Journal of Marine and Coastal Law*, 14(3), 415.

Gjerde, K. & Pullen S. (1998). International Maritime Organisation. Cuba's Sabana-Camaguey Archipelago: the second internationally recognised Particularly Sensitive Sea Area. *The International Journal of Marine and Coastal Law*, 13 (2) 246-253.

Hamburg Port Authority, (2007). *Annual Report 2007* [online]. Hamburg: Hamburg Port Authority. [online] Available from: <http://www.hamburg-port-authority.de/en> [accessed 10th September 2009]

Hardman-Mountford, N., Allen, J., Frost, M., Hawkins, S., Kendall, M., Mieskowska, N. (2005). Diagnostic monitoring of a changing environment: An alternative UK perspective. *Marine Pollution Bulletin*, 50, 1463-1471.

Hocking, S. (2000). Evaluating effectiveness. A framework for assessing the management of Protected Areas. Gland: IUCN.

Huisman, S. and Poulsen P., (2009). Personal Communication. Bremen, Germany 20th August 2009

IMO. (2002a). Convention on the International Maritime Organisation. [online]. Available from: http://www.imo.org/conventions/mainframe.asp?topic_id=77 [accessed 28th July 2010].

IMO. (2002b). MARPOL 73/78. [online]. Available from: http://www.imo.org/conventions/contents.asp?doc_id=678&topic_id=258 [accessed 28th July 2010]

IMO, (2002c). Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 - Amendments to the 1996 Protocol [online]. Available from: http://www.imo.org/Conventions/contents.asp?topic_id=258&doc_id=681 [accessed 14th August 2009]

IMO, (2002d). Nairobi International Convention on the Removal of Wrecks, 2007 [online]. Available from: http://www.imo.org/Legal/mainframe.asp?topic_id=1319 [accessed 7th December 2009]

IMO, (2002e). International Convention for the Control and Management of Ships' Ballast Water and Sediments [online]. Available from: http://www.imo.org/conventions/mainframe.asp?topic_id=867 [accessed 7th December 2009]

IMO, (2002f). Focus on IMO Antifouling Systems [online]. Available from: http://www.imo.org/includes/blastDataOnly.asp/data_id%3D7986/FOULING2003.pdf [accessed 24th November 2009].

IMO. (2013). Introduction to the IMO. [online]. Available from: <http://www.imo.org/>. [accessed 28th October 2013].

IMO. (2010). Special Areas under MARPOL. [online]. Available from: <http://www.imo.org/OurWork/Environment/PollutionPrevention/SpecialAreasUnderMARPOL/Pages/Default.aspx> [accessed 1st November 2010].

IMO. (2011a). Oil pollution - Background. [online]. Available from: <http://www.imo.org/OurWork/Environment/PollutionPrevention/OilPollution/Pages/Background.aspx> [accessed 15th August 2012]

IMO. (2011b). Ships Routeing. [online]. Available from: <http://www.imo.org/ourwork/safety/navigation/pages/shipsrouteing.aspx> [accessed 24th August 2012].

IMO. (2012). Particularly Sensitive Sea Areas. [online]. Available from: <http://www.imo.org/ourwork/environment/pollutionprevention/pssas/Pages/Default.aspx> [accessed 10th August 2012].

ISL, (2008). Shipping Statistics and Maritime Review: Volume 52:12. Bremen: Institute of Shipping Logistics

IUCN (2012). Guidelines for applying the IUCN Protected Areas Management Categories to Marine Protected Areas. [online]. Available

from: https://cmsdata.iucn.org/downloads/uicn_categoriesamp_eng.pdf [accessed 25th March 2013]

Johnson, D.J., Lewey, S., Park, P., Hoar, J., Pourzanjani, M., Fletcher, S., Taver, S. (2001). Particularly Sensitive Sea Area (PSSA) Wadden Sea Feasibility Study. Southampton Institute.

Johnson, D. J., Butt, N. M., & Walmsley, S. (2005). Protecting MPAs from threats posed by international shipping. Proceedings of the first International Marine Protected Areas Congress. Geelong.

Johnson, L. (2009, July 29). Evaluation of PSSAs. (N. Butt, Interviewer)

Kelleher, G., & Kenchington, R. (1992). Guidelines for establishing Marine Protected Areas. Gland: IUCN.

Kenchington, R. (1990). Achieving Marine Conservation through Biosphere Reserve Planning and Management. *Environmental Conservation*, 17(1), 39 -44.

Kenchington, R. (2010). Strategic roles of Marine Protected Areas in Ecosystem Scale conservation. *Bulletin of Marine Science*, 86(2), 303-33.

Kristensen N., (2004). The DPSIR Framework. Paper presented September 2004, UNEP Headquarters, Nairobi, Kenya. [online]. Available from: http://enviro.lclark.edu:8002/rid=1145949501662_742777852_522/DPSIR%20Overview.pdf [accessed 14th September 2012]

LDC. (1972). London Dumping Convention 1972. [online]. Available from: http://www5.imo.org/SharePoint/blastDataOnly.asp/data_id=16925/LC1972.pdf [accessed 7th July 2010].

Lefebvre-Chalain, H., (2007). Fifteen years of Particularly Sensitive Sea Areas: A concept in development. *Ocean & Coastal Law Journal*. Vol 13. (47). [online] Available from: http://mainelaw.maine.edu/academics/oclj/pdf/vol13_1/vol113_oclj_47.pdf [accessed 25th March 2013]

LOSC. (2010). Convention of Law of the Sea.[online]. Available from: http://www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm [accessed 5th November 2010]

Marine Board. (1990). Managing Troubled Waters: The role of marine environmental monitoring. Washington: National Academy Press.

Marisec. (2011). Shipping and world trade. [online]. Available from: <http://www.marisec.org/shippingfacts/worldtrade/> [accessed 10th August 2012]

MEPC, (2011). Marine Environmental Protection Committee; 62nd session. 11th - 15th July 2011. [online]. Available from: <http://www.imo.org/mediacentre/meetingsummaries/mepc/pages/mepc-62nd-session.aspx> [accessed 10th August 2012].

Nehls, G., and S., Witte, 2009. Extraction and Dredging. Thematic Report No. 3.9. In: Marencic, H. & Vlas, J. de (Eds), 2009. *Quality Status Report 2009. WaddenSea Ecosystem No. 25*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.

Nehring, S., K., Reise, N., Dankers and P.S., Kristensen, 2009. Alien species. Thematic Report No. 7. In: Marencic, H. & Vlas, J. de (Eds), 2009. *Quality Status Report 2009. WaddenSea Ecosystem No. 25*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.

Nelson, P. (2003). Protecting Areas that are vulnerable to damage by maritime activities: The reality of Particularly Sensitive Sea Areas. East Asia Seas Conference. December 2003. Malaysia.

NERC-BAS. (2007). The Antarctic Treaty explained. [online]. Available from: http://www.antarctica.ac.uk/about_antarctica/geopolitical/treaty/explained.php [accessed 2nd August 2010]

NOAA. (2012). Ocean. [online]. Available from: <http://www.noaa.gov/ocean.html> [accessed 10th August 2012].

NOAA-LME (2009). Integrated Ecosystems assessments: UNEP Regional Seas Programme linked with Large Marine Ecosystems Assessment and Management. [online]. Available from: http://www.lme.noaa.gov/index.php?option=com_content&view=article&id=210:moduleintroduction&catid=48:lmemodules&Itemid=79 [accessed 25th March 2013]

OILPOL (1954). International Convention for the Prevention of Pollution of the Sea by Oil 1954. [online]. Available from: <http://sedac.ciesin.org/entri/texts/pollution.of.sea.by.oil.1954.html> [accessed 20th August 2011].

OSPAR Commission, 2009. Assessment of the impacts of shipping on the marine environment [online]. Available from: http://www.ospar.org/documents/dbase/publications/p00440_Shipping%20Assessment.pdf [accessed 4th December 2009].

OSPAR, 2010. OSPAR QSR 2010: Chapter 9 Other human uses and impacts [online]. Available from: http://www.qsr2010.ospar.org/en/media/chapter_pdf-Ch09_EN.pdf accessed 26th March 2013].

Ottesen P., (1994). Shipping threats and protection of the Great Barrier Reef - The role of the Particularly Sensitive Sea Area concept. *The International Journal of Marine and Coastal Law*, 9(4), 507-522.

Peet, G. (1994). Particularly Sensitive Sea Areas: a documentary history. *International Journal of Marine and Coastal Law*, 9 (4) 469-506.

Ramsar. (2010). Ramsar Convention on Wetlands. [online]. Available from: http://www.ramsar.org/cda/en/ramsar-home/main/ramsar/1_4000_0 [accessed 2nd August 2010].

Ramsar. (2012a). Ramsar list of wetlands of international importance. [online]. Available from: http://www.ramsar.org/cda/en/ramsar-documents-list/main/ramsar/1-31-218_4000_0 [accessed 24th August 2012].

Ramsar. (2012 b). Montreaux Record. [online]. Available from: http://www.ramsar.org/cda/en/ramsar-documents-montreux-montreux-record-23759/main/ramsar/1-31-118%5E23759_4000_0 [accessed 24th August 2012].

Roberts, J. (2007). Marine Environment protection and biodiversity conservation: The application and future development of the IMO's Particularly Sensitive Sea Area concept. Berlin, Heidelberg, New York: Springer.

Roberts, J., Tsamenji, M., Workman, T., & Johnson, L. (2005, September). The Western European PSSA proposal a "politically sensitive sea area". *Marine Policy*, 29(5), 431-440.

Rogers, S., & Greenway, B. (2005). A UK perspective on the development of marine ecosystem indicators. *Marine Pollution Bulletin* (50) 9-19.

Rogers, S., Tasker, M., Earll, R., & Gubbay, S. (2007). Ecosystem objectives to support the UK vision for the marine environment. *Marine Pollution Bulletin*, (54) 128-144.

Russek-Cohen, E., & Christman, M. (2004). Statistical Methods for Environmental Monitoring and Assessment. In G. B. Wiersman, Environmental monitoring (pp. 391-406). Boca Raton: CRC Press.

Saunders, M., Lewis, P., & Thornhill, M. (2007). Research Methods for Business Students (4th Edition ed.). Harlow: Prentice Hall.

Secretariat of the CBD. (2004). Technical Advice on the establishment and management of a national system of marine and coastal protected areas. UNEP-CBD, Secretariat of the Convention on Biological Diversity. Gland: UNEP.

Sheets, E., & Weterigs, R. (1999). Environmental Indicators: Typology and overview. Copenhagen: European Environment Agency.

Solbe, J. (2005). Long term Monitoring: Why, What, Where, When & How? The Importance of long term monitoring of the environment. Cork: Sherkin Island Marine Station.

SOLAS (2009). Consolidated text of the International Convention for the Safety of Life at Sea, 1974, and its protocol of 1988: articles, annexes and certificates. Incorporating all amendments in effect from 1 July 2009. 5th ed. London. IMO

Stanners, D. *et al.* (2007). Frameworks for Environmental Assessment and Indicators at the EEA. In T. Hak, B. Moldan, & A. Lyon Dahl, Sustainability indicators. A scientific assessment (pp. 127 - 144). Washington: Island Press.

Thai-Eng, C. (1993). Essential elements of integrated coastal zone management. *Ocean & Coastal Zone Management*, 21, 81-108.

The Danish Pilotage Act, (2006). The Danish Pilotage ACT no. 567 of 09/06/2006 [online]. Available

from: http://www.danpilot.dk/fileadmin/danpilot/Fotos/The_Danish_Pilotage_Act_no_567.pdf. [accessed 16th August 2009]

Thorsell, J., Ferster, R., & Sigaty, T. (1997). A Global Overview of Wetland and Marine Protected Areas on the World heritage List: a contribution to the Global Theme Study of World Heritage Natural Sites. IUCN, Natural Heritage Programme. Gland: IUCN.

TNC, (2012). The Nature Conservancy Policy Brief. UN CBD COP11, India, October 2012. [online] Available from: <http://www.nature.org/newsfeatures/pressreleases/tnc-marine-policy-brief-2012.pdf> [accessed 26th June 2013)

Trochim, W. M. (2006). Research Knowledge database: Likert Scale. [online]. Available from: <http://www.socialresearchmethods.net/kb/scallik.php> [accessed 24th June 2011].

Uggla, Y. (2007). Environmental Protection and freedom of the high seas; The Baltic Sea as a PSSA from the Swedish perspective. *Marine Policy*, (31) 251-257.

UKHO, (2007). Admiralty Sailing Directions. North Sea Pilot. United Kingdom Hydrographic Office. Taunton: UKHO

UNCHE. (1972). Declaration of the United Nations Conference on the Human Environment. [online]. Available from: <http://www.unep.org/Documents/Multilingual/Default.asp?documentid=97&articleid=1503> [accessed 4th July 2011].

UNCLOS. (2012). Part XII. Protection and Preservation of the Marine Environment. United Nations Convention of the Law of the Sea. [online] Available

from: http://www.un.org/Depts/los/convention_agreements/texts/unclos/part12.htm
[accessed 14th November 2012]

UNCLOS. (2013). Chronological list of ratifications of, accessions and successions.
[online]. Available
from: http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm
[accessed 5th November 2013].

UNCTAD, (2008). Review of Maritime Transport 2008 [online]. New York: United Nations. Available from: http://www.unctad.org/en/docs/rmt2008_en.pdf [accessed 1st December 2009]

UNCTAD, (2009). Review of Maritime Transport 2009 [online]. New York: United Nations. Available from: http://www.unctad.org/en/docs/rmt2009_en.pdf [accessed 19th February 2010]

UNCTAD. (2011). Review of Maritime Transport 2011. Geneva: United Nations.
[online]. Available from: http://www.unctad.org/en/docs/rmt2011_en.pdf [accessed 1st February 2012]

Underdahl, A. (1980). Integrated Marine Policy - What? Why? How? *Marine Policy*, 159-169.

UNEP. (1972). United Nations Environmental Programme - Stockholm Conference. B: Marine Pollution. [online]. Available
from: <http://www.unep.org/Documents/Multilingual/Default.asp?DocumentID=97&ArticleID=1510&l=en> [accessed 11th November 2010].

UNEP. (2006). UNEP Regional Seas Programme: Convention on Biological Diversity. [online] Available from: <http://www.unep.ch/regionalseas/legal/cbd.htm> [accessed 11th July 2011].

UNEP, 2009. Marine Litter: A Global Challenge [online]. Nairobi: UNEP. Available from: http://www.unep.org/pdf/UNEP_Marine_Litter-A_Global_Challenge.pdf.
[accessed 12th November 2009]

UNEP. (2012). UNEP Environment for development: Regional Seas Programme. [online]. Available from: <http://www.unep.org/regionalseas/default.asp> [accessed 24th August 2012].

UNEP-CBD. (2011). Convention on Biological Diversity. Tools and Guidance: Marine Protected Areas Guidance. [online]. Available
from: <http://www.cbd.int/marine/tools.shtml> [accessed 11th July 2011].

UNESCO. (2008). Operational Guidelines for the Implementation of the World Heritage Convention. World Heritage Centre, Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage. Paris: UNESCO.

UNESCO. (2009). World Network of Biosphere Reserves. [online]. Available from: http://www.unesco.org/mab/doc/brs/brs_ramsar_whc.pdf [accessed 6th August 2010].

UNESCO. (2010a). Statutory Framework of Biosphere Reserves. [online]. Available from: <http://www.sovereignty.net/tline/statutory-framework.htm> [accessed 5th July 2011].

UNESCO. (2010b). Natural Sciences, People, Biodiversity and Ecology. [online]. Available from: http://portal.unesco.org/science/en/ev.php-URL_ID=6784&URL_DO=DO_TOPIC&URL_SECTION=201.html [accessed 2nd August 2010].

UNESCO. (2012). World Heritage Marine Sites. [online]. Available from: <http://whc.unesco.org/en/marine-programme/> [accessed 24th August 2012].

UNESCO. (2012a). Directory of the World Network of Biosphere Reserves. [online]. Available from: <http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/world-network-wnbr/wnbr/> [accessed 24th August 2012]

United Nations (2012). World Heritage Convention. [online]. Available from: <http://whc.unesco.org> [accessed 24th August 2012].

Van Beusekom, *et al.* (2009). Eutrophication Thematic Report No. 6. In: Marencic, H. & Vlas, J. de (Eds), 2009. *Quality Status Report 2009. WaddenSea Ecosystem No. 25*. Wilhelmshaven, Germany: Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group.

Van Houdt, F., (2008) 'A Vision and Action Plan for an Integrated Maritime Policy' *Greenports and EcoPorts Conference*. Greenport and EcoPort, Amsterdam. (27-28 February). [online]. Available from: http://www.green-port.net/images/stories/green_port_conference/Presentations08/021-florencia_van_houdt_presentation.pdf [accessed 7th December 2009]

Van Tatenhove, J. (2010). Integrated Marine Governance: Rethinking legitimacy and Accountability. Regulation in the Age of Crisis, (pp. 2-21). Dublin.

Wadden Sea (1982). Joint Declaration on the protection of the Wadden Sea. [online]. Available from: <http://www.waddensea-secretariat.org/tgc/Declaration.html> [accessed 26th March 2013]

Wadden Sea (2013). World Heritage Nomination. [online]. Available from: <http://www.waddensea-secretariat.org/management/whs/whs.html> (accessed 26th March 2013)

Wadden Sea Plan, 1997. WSP Mineral extraction and infrastructure section 4.1.10 [online]. Available from: <http://www.waddensea-secretariat.org/tgc/Wsp/04Tidalarea.html> [accessed 30th November 2009]

Wiersma, G. (2004). Environmental Monitoring. Boca Raton, London, New York, Washington: CRC Press.

Wisker, G. (2008). The post graduate research handbook. 2nd Edition. Basingstoke: Palgrave Macmillan.

Wood, L. (2007a). Dry Tortugas National Park. MPA Global: A database of the world's marine protected areas. Sea Around Us project. UNEP-WCMC & WWF. [online]. Available from: http://www.mpaglobal.org/index.php?action=showMain&site_code=61706 [accessed 4th August 2010].

Wood, L. (2007b). Fort Jefferson National Monument. MPA Global: A database of the world's marine protected areas, Sea Around Us project. UNEP-WCMC & WWF. [online]. Available from: http://www.mpaglobal.org/index.php?action=showMain&site_code=1028 [accessed 4th August 2010].

World Heritage List. (2012). UNESCO World Heritage Centre. [online]. Available from: <http://whc.unesco.org/en/list> [accessed 24th August 2012].

World Port Source, 2005-2010. Port of Wilhelmshaven [online]. Available from: http://www.worldportsource.com/ports/DEU_Port_of_Wilhelmshaven_1260.php [accessed 23rd December 2009].

World VTS Guide, (2009). Germany-German Bight. [online]. Available from: <http://www.worldvtsguide.org/Germany/German-Bight> [accessed 1st November 2009].

WSF, (2008). Inventory of Waddensee Energy/Harbour/Industry projects. [online]. Available from: http://www.waddensea-forum.org/archive/MeetingsArchive/WSF-docs/WSF13documents/WSF-13-8-2%20Inventory%20Waddensea%20all_new.pdf [accessed 28th November 2009].

WWF. (2005). An overview of Marine Protected Areas in the UK. [online] Available from: http://www.wwf.org.uk/filelibrary/pdf/ma_overviewukmpa.pdf [accessed 5th August 2010].

Zacharias, M., & Geger, E. (2005, February). Sensitivity and vulnerability in the marine environment: an approach to identifying vulnerable areas. *Conservation Biology*, 19(1), 86-97.

10.1 IMO Resolutions and MEPC Session Agenda Items

Resolution A.927 (22) adopted 15.01.2002 – Guidelines for the designation of Special Areas under MARPOL 73/78 and guidelines for the identification of Particularly Sensitive Sea Areas

Resolution A.982 (24) adopted on 1.12.2005 – Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas.

9.1.2 MEPC Session Agenda Items

MEPC 48/7/2 - Identification and protection of Special areas and Particularly Sensitive Sea Areas: Designation of the Wadden Sea as a Particularly Sensitive Sea Area: Submitted by Denmark, Germany and the Netherlands

MEPC 65/22 – Report of the Marine Environmental Protection Committee on its 65th session. 24 May 2013

10.2 IMO Conventions

IMO Conventions in Force

International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001.

International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1996 Protocol.

International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78).

International Convention on Standards of Training, Certification and Watch-keeping 1995.

The Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000 (OPRC-HNS Protocol).

IMO Conventions Adopted

The International Convention for the Control and Management of Ships Ballast Water and Sediments adopted in 2004.

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships adopted in 2009.

The Nairobi International Convention on Removal of Wrecks adopted in 2007.

10.3 EU Directives and Regulations

EU Directives

Directive 2005/35/EC of the European Parliament and of the Council of 7 September 2005 on ship-source pollution and on the introduction of penalties for infringements.

DIRECTIVE 2009/15/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on common rules and standards for ship inspection and survey organisations and for the relevant activities of maritime administrations.

DIRECTIVE 2009/16/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on Port State control.

DIRECTIVE 2009/17/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 amending Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system.

DIRECTIVE 2009/18/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC of the European Parliament and of the Council.

DIRECTIVE 2009/20/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the insurance of ship-owners for maritime claims.

DIRECTIVE 2009/21/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on compliance with flag State requirements.

EU Regulations

Regulation (EC) No 782/2003 of the European Parliament and of the Council of 14 April 2003 on the prohibition of organotin compounds on ships [Official Journal L 115 of 9.5.2003].

REGULATION (EC) No 391/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on common rules and standards for ship inspection and survey organisations.

REGULATION (EC) No 392/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the liability of carriers of passengers by sea in the event of accidents.

Year	Conventions and Protocols	Known as	Level	
1933	Convention Relative to the Preservation of Fauna and Flora in their Natural State	London Convention	I	T
1940	Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere	Western Hemisphere Convention	R	M
1946	International Convention on the Regulation of Whaling		I	M
1950	International Convention for the Protection of Birds		I	T
1959	The Antarctic Treaty		I	M
1964	Agreed Measures for the Conservation of Antarctic Fauna and Flora		I	T
1968	African Convention on the Conservation of Nature and Natural Resources		R	
1970	Man and Biosphere programme	MAB	I	M
1971	Convention on Wetlands of International Importance especially as Waterfowl Habitat	Ramsar Convention	I	M
1972	Declaration on the Human Environment	Stockholm Conference	I	M
1972	Convention Concerning the Protection of the World Culture and Natural Heritage	WHC	I	M
1972	Convention for the Conservation of Antarctic Seals		I	M
1974	UNEP Regional Seas Programme	RSP	I	M
1974	International Convention for the Safety of life at Sea	SOLAS	I	M
1976	Convention for the Protection of the Mediterranean Sea Against Pollution	Barcelona Convention	R	M
1976	Convention on the Conservation of Nature in the South Pacific	Apia Convention	R	M
1976	European Network of Biogenetic Reserves: Resolution of the Committee of Ministers of the Council of Europe		R	T
1978	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto	MARPOL 73/78	I	M

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1978	Kuwait Regional Convention for the Co-Operation on the Protection of the Marine Environment from Pollution	Kuwait Convention	R	M
1979	Convention on the Conservation of European Wildlife and Natural Habitats	Bern Convention	R	M
1979	Council Directive on the conservation of wild birds (EU)	Wild Birds Directive	R	T
1979	Convention on the Conservation of Migratory Species of Wild Animals	Bonn Convention	I	T
1980	Convention on the Conservation of Antarctic Marine Living Resources	CCAMLR	I	M
1980	European outline Convention on Trans frontier Co-Operation between Territorial Communities or Authorities		R	T
1981	Convention for Co-Operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region	Abidjan Convention	R	M
1981	Convention for the Protection of the Marine Environment and Coastal Area of the Southeast Pacific	Lima Convention	R	M
1982	United Nations Convention of the Law of the Sea	UNCLOS	I	M
1982	Protocol concerning Mediterranean Specially Protected Areas	SPA Protocol	R	M
1982	Regional Convention for the Conservation of the Red Sea and Gulf of Aden environment	Jeddah Convention	R	M
1983	Convention for the Protection and Development of the Marine Environment of the Wider Caribbean area	Cartegena convention	R	M
1985	Agreement on Conservation of Nature and Natural Resources	ASEAN	R	M
1985	Convention on the Protection, Management and Development of the Marine and Coastal Environment of East Africa	Nairobi Convention	R	M
1985	Protocol Concerning Protected Areas and Wild Fauna and Flora in the eastern African Region		R	T
1986	Convention for the Protection of Natural Resources and the Environment of the South Pacific Region	SPREP	R	M
1989	Protocol for the Conservation and Management of Protected Marine and Coastal areas of the Southeast Pacific		R	M
1990	Protocol concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean	SPAW Protocol	R	M

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1991	Arctic Environmental Protection Strategy		I	M
1991	Protocol to the Antarctic Treaty on Environmental Protection		I	M
1992	Convention on Biological Diversity	CBD	I	M
1992	Council Directive on the Conservation of natural habitats and wild fauna and flora (EU)	Habitats Directive	R	T
1992	Convention on the Protection of the Black Sea from Pollution	Bucharest Convention	R	M
1992	Convention for the Protection of the Marine Environment of the Northeast Atlantic - Oslo Paris Convention	OSPAR Convention	R	M
1992	Convention on the Protection of the Marine Environment in the Baltic sea	Helsinki Convention	R	M
1995	Statutory Framework of the World Network of Biosphere Reserves		I	M
1995	Protocol Concerning Specially protected Areas and Biological Diversity in the Mediterranean	SPA/ Biodiversity Protocol	R	M
2001	Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Trans boundary Movement and Management of Hazardous Wastes within the South Pacific Region	Waigani Convention	R	M
2002	Convention for cooperation in the protection and sustainable development of the marine and coastal environment of the North East Pacific	Antigua Convention	R	M
2006	Convention for the Protection of the Marine Environment of the Caspian Sea	Tehran Convention	R	M
	KEY: I = International R= Regional M= Marine element T = Terrestrial			

(source: Author)

EVALUATION OF PSSAS: DEVELOPMENT, LEGISLATION & EFFECTIVENESS

The IMO defines a PSSA as

“.....an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific attributes where such attributes may be vulnerable to damage by international shipping activities”.
Resolution A.982 (24)

The following questions are asked in order to identify key issues and areas of concern with PSSAs. You may be as brief or as expansive as you wish with your answers. Please feel free to refer to any literature that in your opinion expands your answer. Once results have been received from all participants we will identify key elements that will be circulated for further discussion.

1. Do PSSAs currently fulfil their function as an effective protective mechanism?
If not, why not? And if so, in what ways?
2. Do you think that the current PSSAs designations are appropriate? Please identify and give brief reasons for your answer.
3. Could the designation process be improved? If so how?
4. Could the legislative process be improved? i.e. Could the legal framework benefit from additions/modification to give a designated area more protection
5. In your opinion do you feel that **all** stakeholders are adequately and appropriately informed about the function and purpose of PSSAs? If no, please explain.
6. Do you feel that existing Associated Protective Measures (APMs) allow sufficient protection for a designated area?
7. What (if any) additional APMs that are not presently available within the present guidelines set by the IMO, do you feel may be appropriate to enhance level of protection?
8. When evaluating the effectiveness of a PSSA, which criteria would you suggest were included? Please rank your criteria in order of importance (1 being most important)

<p>1. Do PSSAs currently fulfil their function as an effective protective mechanism? If not, why not? And if so, in what ways?</p>	<p>May be helping conservation, but appears to be lower capacity of PSSAs in developing countries. Therefore not fulfilling function in an equitable manner. (MP)</p> <p>Two step procedures (designation – APM at time or later) weakened status. Compulsory pilotage as APM contrary to UNCLOS in international straits. New APMs need adopting. (AM)</p> <p>No – largely because it is ignored by shipping sector (Wadden Sea). Generally not represented well on nautical charts. International shipping is outside the designated area (Wadden Sea). (HR)</p> <p>Broadly No. Questions relating to Application of concept, Value of PSSA designation, Manner of designation, Rigour of IMO assessment, Effectiveness of implementation – this being crucial to the success of a PSSA designation (JR)</p>
<p>2. Do you think that the current PSSAs designations are appropriate? Please identify and give brief reasons for your answer</p>	<p>Some PSSAs do not appear to be under threat from international shipping, away from main shipping lanes and only threat exists from national traffic (Galapagos). Misdirected use of designation, what was motivation. (MP)</p> <p>Wadden Sea, Western Europe, Baltic – issues with APM/no APM – what is the purpose of designation. (AM)</p> <p>Wadden Sea - Poor representation on charts, no APMs (HR)</p> <p>Some are but many are not. The way in which PSSA concept is interpreted and applied by the involved States has a bearing. Appropriate : GBR, Torres, Florida Keys, Galapagos (? Over APM). Inappropriate: Baltic, Western Europe, Malpelo, Canary. Generally issues are usually related to APM (JR)</p>
<p>3. Could the designation process be improved? If so how?</p>	<p>A systematic proactive assessment of marine areas likely to benefit from designation should be carried out on a global basis, instead of waiting for countries to propose them. Existing internationally recognised marine protected areas would make a good starting point. (MP)</p> <p>Shipping society needs to be convinced that PSSA status is really needed and can give protection both to nature and socio economic values (fisheries, aquaculture, tourism). Suggest sensitivity mapping followed by risk analysis (shipping) with combative measures identified, should be conducted prior to PSSA application. (AM)</p> <p>APMs should be included within any designation. (HR)</p> <p>Yes – presently lacks a degree of legitimacy. Current IMO review of process is <i>ad hoc</i> and is applied in an inconsistent manner (A list of recommendations is provided by JR)</p>

4. Could the legislative process be improved? i.e. Could the legal framework benefit from additions/modification to give a designated area more protection	<p>Legally binding monitoring process and public awareness raising after designation should be demanded. Evaluation and reporting of shipping incidents and accidents within area should be mandatory (every 3 years). To demonstrate how protective the designation is. (AM)</p> <p>Clearly a need for further clarification to improve the overall understanding of the scope and limitations of PSSA process. PSSA concept would benefit from having a legal basis in its own rights. Most importantly there should be a review of and augmentation of present protective measures available (JR)</p>
5. In your opinion do you feel that <u>all</u> stakeholders are adequately and appropriately informed about the function and purpose of PSSAs? If no, please explain.	<p>Unaware of any existing strategy to communicate PSSA. Stakeholders should include national protection agencies, fishing agencies, tourism agencies, conservation NGOs.(MP)</p> <p>Absolutely not. Fishermen, tourism industry and seafarers must be better informed of purpose in order to understand benefits and how to follow regulations. (AM)</p> <p>No. Shipping sector poorly informed. (HR)</p> <p>NO – crucially mariners are poorly informed (JR)</p>
6. Do you feel that existing Associated Protective Measures (APMs) allow sufficient protection for a designated area?	<p>Fairly comprehensive list but could be improved with additional measures. (AM)</p> <p>None for Wadden Sea. (HR)</p> <p>No – although IMO is working on this. Coastal states are neglecting their own rights within territorial waters under UNCLOS and should implement some of the measures adopted by US – ATBA, no anchoring etc. (JR)</p>
7. What (if any) additional APMs that are not presently available within the present guidelines set by the IMO, do you feel may be appropriate to enhance level of protection?	<p>Structure of vessel and competency of crews should be listed as an APM (eg. ice classification/ ice navigation). (AM)</p> <p>New risks from Offshore wind farms – spatial planning (?). (HR)</p> <p>See above (JR)</p>

APPENDIX C

<p>8. When evaluating the effectiveness of a PSSA, which criteria would you suggest were included? Please rank you criteria in order of importance (1 being most important)</p>	<ol style="list-style-type: none"> 1. Capacity of the country in question to monitor implementation of APMs 2. Capacity of the country in question to react to infractions. 3. Frequency of pollution incidents intended to be reduced by the application of APMs. (MP) <ol style="list-style-type: none"> 1. Conducted risk analysis to discover what are the risks and risk areas and what could be the best APMs to combat the risks. 2. The number of avoided accident/ decreased number of accidents and near miss cases. 3. The comparison between the enforced APMs and those discovered to be the best ones. 4. Awareness on PSSA among all stakeholders (questionnaire). (AM) <ol style="list-style-type: none"> 1. Are there direct positive effects for nature/environment by behaviour/activities in the shipping sector. 2. Are there indirect positive effects for nature/environment by behaviour/activities in the shipping sector (e.g. more awareness, with the actual effect hardly be measurable). 3. Are there indirect positive effects for nature/environment by supporting regulations which may have positive effects without being APMs in a formal sense and which may not exist without the PSSA being there. (HR) <ol style="list-style-type: none"> 1. Were objectives established for the PSSA at the outset and have these objectives been met in full/part. Were they measured? 2. What periodic evaluations have been undertaken to compare environmental damage, or the risk posed by shipping, before and after the PSSA designation? Has there been any significant change in damage/risk that can be attributed to the PSSA designation? 3. Have the APMs implemented actually responded to the threat identified to the specific values of the PSSA? 4. If 'no' to 3 above, what additional APMs are needed to respond to the threat? 5. What monitoring and enforcement action is/has been taken in respect of compliance with the APMs. E.g. PSC inspections, fines, etc. 6. Has any legal protection been put in place at the national level to give effect to the PSSA designation? 7. What level of awareness is there of the PSSA among marine resource users of the area in question. 8. Has a management plan been put in place for the area? If so, what context does the PSSA have in that management plan? 9. What other protection measures have been put in place within or in the vicinity of the PSSA to respond to other (non-shipping) threats posed to the area. NOTE - This does not help evaluate the effectiveness of the PSSA per se but it does help to evaluate the overall management response to the protection of the area, to assess in what context the PSSA was developed. (JR)
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PRESSURE INDICATORS

- Shipping Volume by type
- Shipping incidents - all
- Collisions - low impact
- Collisions - High impact
- Oil spills reported
- Oil spill by volume
- Oil spill by type
- Loss of cargo/containers
- Oil & gas production
- Wind Farms in situ
- Wind Farms - proposed
- Dredged spoil - removed
- Dredged spoil - dumped
- Fishing
- Shell fishery
- Marine tourism by number
- Marine tourism by activity

STATE INDICATORS

- Winter nitrate concentration
- Winter phosphate concentration
- N:P ratio
- Chlorophyll a concentration
- TBT concentration
- Pesticide/organo-chloride - bird eggs
- Heavy metal concentrations
- Non indigenous species by number
- Marine mammals by number
- Landed catch - blue mussel
- Landed catch - cockles
- Landed catch - shrimp
- PAH in sediments/shellfish
- Oiled birds
- Marine litter - total number
- Marine litter - type

RESPONSE INDICATORS

- APM development
- Communication to mariners
- Local agreements
- Co-ordination between states
- Oil spill response plans
- Stakeholder education/awareness

Type	Indicator	Strength of link to maritime activity	Potential risk to Marine Environment	Value	Relevant strength of indicator to PSSA	Relevance SSU	SC
P	Shipping Volume by type	5	4	9	5	45	40.5
P	Shipping incidents - all	5	4	9	5	45	45
P	Collisions - low impact	5	4	9	5	45	31.5
P	Collisions - High impact	5	5	10	5	50	50
P	Oil spills reported	5	4	9	5	45	36
P	Oil spill by volume	5	4	9	5	45	45
P*	<i>Oil spill by type</i>	5	4	9	5	45	*
P*	<i>Loss of cargo/containers</i>	5	3	8	4	32	*
P	Oil & gas production	5	3	8	5	40	24
P	Wind Farms in situ	5	2	7	3	21	28
P	Wind Farms - proposed	5	3	8	4	32	27
P	Dredged spoil - removed	5	4	9	4	45	22.5
P	Dredged spoil - dumped	5	3	8	4	32	32
P	Fishing	5	2	7	3	21	24.5
P	Shell fishery	5	2	7	3	21	24.5
P	Marine tourism by number	4	3	7	3	21	24.5
P	Marine tourism by activity	4	3	7	4	28	24.5

P - Pressure

High relevance

Moderate relevance

Low relevance

P Added by SC in Bremen*

PRESSURE, STATE, RESPONSE INDICATOR SUITE

APPENDIX E

Type	Indicator	Strength of link to maritime activity	Potential risk to Marine Environment	Value	Relevant strength of indicator to PSSA	Relevance SSU	SC
S	Winter nitrate concentration	1	2	3	3	9	9
S	Winter phosphate concentration	1	3	4	3	12	12
S	N:P ratio	1	3	4	3	12	14
S	Chlorophyll a concentration	1	2	3	3	9	7.5
S	TBT concentration	4	3	7	5	35	31.5
S	Pesticide/organochloride - bird eggs	0	1	1	0	0	2.5
S	Heavy metal concentrations	1	3	4	3	12	8
S	Non indigenous species by number	4	5	9	5	45	31.5
S	Marine mammals by number	2	2	4	4	20	8
S	Landed catch - blue mussel	3	3	6	3	18	15
S	Landed catch - cockles	3	3	6	3	18	15
S	Landed catch - shrimp	3	3	6	3	18	15
S	PAH in sediments/shellfish	3	3	6	3	18	17.5
S	Oiled birds	3	2	5	3	15	25
S	Marine litter - total number	2	3	5	3	15	20
S	Marine litter - type	2	3	5	4	20	20
R	APM development	5	3	8	5	40	36
R	Communication to mariners	5	4	9	5	45	45
R	Local agreements	4	3	7	3	21	31
R	Co-ordination between states	5	4	9	4	36	45
R	Oil spill response plans	5	4	9	5	45	45
R	Stakeholder education/awareness	5	4	9	4	36	31.5

S - State R - Response

APPENDIX E

Indicator	Source	Availability
Winter nitrate concentration	TMAP & QSR 2004/2009	TMAP only shows levels over short period of time (winter months) so monthly means throughout the year were sourced from chapter's author. From 1989 to present
Winter phosphate concentration	TMAP & QSR 2004/2009	
N:P ratio	TMAP & QSR 2004/2009	Data available since late 1970s, mainly in graph format.
Chlorophyll a concentration	TMAP & QSR 2004/2009	Data collected since the late 1970s mainly in graph format.
TBT concentration	TMAP & QSR 2004/2009	Data collected since the 1990s mainly in graph format.
Pesticide/organochloride - bird eggs	TMAP & QSR 2004/2009	Data collected since the 1980s mainly in graph format.
Heavy metal concentrations	TMAP & QSR 2004/2009	Data collected since the 1980s mainly in graph format
Non indigenous species	QSR 2004/2009	Many species have been identified some dating back as far as the 1920s.
Marine mammals	TMAP & QSR 2004/2009	Data available since 1980s
Landed catch - blue mussel	TMAP & QSR 2004/2009	Locations of beds and fisheries, quantity landed
Landed catch - cockles	QSR 2004/2009	
Landed catch - shrimp	QSR 2004/2009	
PAH in sediments/shellfish	TMAP & QSR 2004/2009	Data available from QSR 2004 since 1987, mainly in graph format.
Oiled birds	TMAP & QSR 2004/2009	Data collected since 1982, mainly in graph format
Marine litter	QSR 2004/2009. OSPAR QSR 2010	Types & volumes, source of the marine litter cannot be clearly established.
Shipping Volume by type	ISL Yearbooks	Not available through trilateral States, figures from the Northern Range ports (includes non-Wadden Sea ports)
Shipping incidents - all		Data limited and inconsistent.

Oil & gas production	UKHO nautical charts 1423 and 1408	The charts show the production platforms and pipelines.
Wind Farms in situ	BSH & spatial planning document, UKHO charts 1423 & 1408	The charts show all existing and all under construction.
Wind Farms - proposed	BSH & spatial planning document	Full list of all proposed wind farms, but lacks specific locations (no co-ordinates).
Dredged spoil - removed	OSPAR	Removed from river estuaries and harbours. Data collected since 1989, showed as a graph and map of sites.
Dredged spoil - dumped	OSPAR	Graph and maps from OSPAR
Fishing	QSR 2004/2009	Quantity landed
Indicator	Source	Availability
Shell fishery	QSR 2004/2009	Quantity landed
Marine tourism	QSR 2004/2009	Data collected since 1980s mainly shown in graph format
APM development	MEPC 48	TSS & DWR already existing, no further APMs proposed.
Communication to mariners	UKHO charts 1423 & 1408 BSH routing chart German Bight	PSSA not marked on UKHO charts. On BSH routing chart. Marked on Dutch and Danish charts. On Electronic charts.
Local agreements	Stade 1997, Schiermonnikoog Declaration	Full texts available.
Co-ordination between states	CWSS, TMAP, DENGERNETH, Schiermonnikoog Declaration	All of these agreements show that the three States are working together to some extent.
Oil spill response plans	DENGERNETH	Full plan available – not yet ratified by German and the Netherlands.
Stakeholder education/awareness	Questionnaire carried out by SSU with help from trilateral States.	Wide range including: German & Netherlands stakeholders both on and offshore, seafarers from Warsash Maritime Academy UK. Data from Denmark incompatible.

Indicator suite – availability of data

APPENDIX F

		Germany		The Netherlands	Denmark
		Lower Saxony	Schleswig-Holstein		
Shipping incidents	Data range	1990 to present from WSD North-East	From 2005 to present from WSD North	2006 only – from MARIN report	From 2000 to present – from Danish Admiralty
	Ship type	Recorded	Not recorded	Not recorded	Not recorded
	Location	Co-ordinates given	Initial data no co-ordinates New data received including co-ordinates	No co-ordinates but map with specific areas which could be used for GIS model.	Co-ordinates given
	Type of incident	Recorded- ‘collision’	Recorded	Recorded	Limited
	Cause of incident	Recorded- ‘false navigation’	Recorded	Not recorded	Not recorded
	Damage caused	Recorded – ‘total loss’	Recorded- ‘damage to both vessels’	Not recorded	Not recorded
	Number of injuries	Recorded- personal injuries-deaths/heavy /light injuries	Not recorded	Not recorded	Not recorded
Collision–low impact		All of the collisions reported can be seen as low impact.			
Collision-high impact		For all three countries no high impact incidents have been reported since the Pallas in 1998.			
Oil spills reported		Limited ‘fuel lost’ ‘pollution to the environment’ – no specifics	None recorded in shipping data.	None recorded in shipping data.	Reported – ‘spill from ship’ ‘suspected oil stain’ ‘land based oil’.
	Bonn Agreement	Data from aerial surveillance shows images of oil density and oil spills of the North Sea & Wadden Sea			
Oil pollution by type		Not recorded – ‘fuel lost’ no type given.	Not recorded	Not recorded	Type of oil is recorded, e.g. mineral oil & gasoline
Oil pollution by volume		For all three countries no amounts of oil were recorded in the event of a spill.			

Indicator suite - availability of data

APPENDIX E

Resolution 9 of the 1978 International Conference on Tanker Safety and Pollution Prevention

- (a) to pursue its efforts in respect of the protection of the marine environment against pollution from ships and dumping of wastes;
- (b) to initiate, as a matter of priority and in addition to the work under way, studies, in collaboration with other relevant organizations and expert bodies, with a view to:
 - i) making an inventory of sea areas around the world which are in special need of protection against marine pollution from ships and dumping, on account of the areas' particular sensitivity in respect of their renewable natural resources or in respect of their importance for scientific purposes;
 - ii) assessing, inasmuch as possible, the extent of the need of protection, as well as the measures which might be considered appropriate, in order to achieve a reasonable degree of protection, taking into account also other legitimate uses of the seas;
- (c) to consider, on the basis of the studies carried out accordingly and the results of other work undertaken, what action will be needed in order to enhance the protection of the marine environment from pollution from ships and dumping of wastes;
- (d) to take action, when appropriate, in accordance with the established procedure, with a view to incorporating any necessary provisions, within the framework of relevant conventions, as may be identified as a result of the above studies;
- (e) to formulate a recommendation to the Consultative Meeting of Contracting Parties that appropriate steps be taken within the framework of the London Dumping Convention, to protect such particularly sensitive sea areas from pollution caused by dumping.

(in Peet, 1994, Annex 1 p502-503)

London Dumping Convention (1972) - Annex III

Provisions to be considered in establishing criteria governing the issue of permits for the dumping of matter at sea, taking into account article IV(2), include:

A - Characteristics and composition of the matter

1. Total amount and average composition of matter dumped (e.g. per year).
2. Form, e.g. solid, sludge, liquid, or gaseous.
3. Properties: physical (e.g. solubility and density), chemical and biochemical (e.g. oxygen demand, nutrients) and biological (e.g. presence of viruses, bacteria, yeasts, parasites).
4. Toxicity.
5. Persistence: physical, chemical and biological.
6. Accumulation and biotransformation in biological materials or sediments.
7. Susceptibility to physical, chemical and biochemical changes and interaction in the aquatic environment with other dissolved organic and inorganic materials.
8. Probability of production of taints or other changes reducing marketability of resources (fish, shellfish, etc.).
9. In issuing a permit for dumping, Contracting Parties should consider whether an adequate scientific basis exists concerning characteristics and composition of the matter to be dumped to assess the impact of the matter on marine life and on human health.

B - Characteristics of dumping site and method of deposit

1. Location (e.g. co-ordinates of the dumping area, depth and distance from the coast), location in relation to other areas (e.g. amenity areas, spawning, nursery and fishing areas and exploitable resources).
2. Rate of disposal per specific period (e.g. quantity per day, per week, per month).
3. Methods of packaging and containment, if any.
4. Initial dilution achieved by proposed method of release.
5. Dispersal characteristics (e.g. effects of currents, tides and wind on horizontal transport and vertical mixing).
6. Water characteristics (e.g. temperature, pH, salinity, stratification, oxygen indices of pollution-dissolved oxygen (DO), chemical oxygen demand (COD), biochemical

oxygen demand (BOD) - nitrogen present in organic and mineral form including ammonia, suspended matter, other nutrients and productivity).

7. Bottom characteristics (e.g. topography, geochemical and geological characteristics and biological productivity).

8. Existence and effects of other dumpings which have been made in the dumping area (e.g. heavy metal background reading and organic carbon content).

9. In issuing a permit for dumping, Contracting Parties should consider whether an adequate scientific basis exists for assessing the consequences of such dumping, as outlined in this Annex, taking into account seasonal variations.

C - General considerations and conditions

1. Possible effects on amenities (e.g. presence of floating or stranded material, turbidity, objectionable odour, discolouration and foaming).

2. Possible effects on marine life, fish and shellfish culture, fish stocks and fisheries, seaweed harvesting and culture.

3. Possible effects on other uses of the sea (e.g. impairment of water quality for industrial use, underwater corrosion of structures, interference with ship operations from floating materials, interference with fishing or navigation through deposit of waste or solid objects on the sea floor and protection of areas of special importance for scientific or conservation purposes).

4. The practical availability of alternative land-based methods of treatment, disposal or elimination, or of treatment to render the matter less harmful for dumping at sea.

(LDC, 1972)

WORLD HERITAGE LIST – MARINE SITES

Aldabra Atoll

Area de Conservación Guanacaste

Banc d'Arguin National Park

Belize Barrier Reef Reserve System

Brazilian Atlantic Islands: Fernando de Noronha and Atol das Rocas Reserves

Cocos Island National Park

Coiba National Park and its Special Zone of Marine Protection

East Rennell

Everglades National Park

Galápagos Islands

Gough and Inaccessible Islands

Great Barrier Reef

Gulf of Porto: Calanche of Piana, Gulf of Girolata, Scandola Reserve

Ha Long Bay

Heard and McDonald Islands

High Coast / Kvarken Archipelago

Ibiza, Biodiversity and Culture

iSimangaliso Wetland Park

Islands and Protected Areas of the Gulf of California

Kluane / Wrangell-St Elias / Glacier Bay / Tatshenshini-Alsek

Komodo National Park

Lagoons of New Caledonia: Reef Diversity and Associated Ecosystems

Macquarie Island

Malpelo Fauna and Flora Sanctuary

Natural System of Wrangel Island Reserve

New Zealand Sub-Antarctic Islands

Ningaloo Coast

Ogasawara Islands

Papahānaumokuākea

Península Valdés

Phoenix Islands Protected Area

Puerto-Princesa Subterranean River National Park

Rock Islands Southern Lagoon

Shark Bay, Western Australia

Shiretoko

Sian Ka'an

Socotra Archipelago

St Kilda

Sundarbans National Park

Surtsey

The Sundarbans

The Wadden Sea

Tubbataha Reefs Natural Park

Ujung Kulon National Park

West Norwegian Fjords – Geirangerfjord and Nærøyfjord

Whale Sanctuary of El Vizcaino

(UNESCO, 2012)

CATEGORY	DESIGNATION	DESCRIPTION
Ia	Strict Nature Reserve: protected area managed mainly for science	<p>Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.</p> <p><i>For Category Ia MPAs or zones, the use of the surrounding waters, marine connectivity and particularly “up-current” influences, should be assessed and appropriately managed.</i></p>
Ib	Wilderness Area: protected area managed mainly for wilderness protection	<p>Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.</p> <p><i>Category Ib areas in the marine environment should be sites of relatively undisturbed seascape, significantly free of human disturbance (e.g. direct or indirect impacts, underwater noise, light pollution etc), works or facilities and capable of remaining so through effective management</i></p>
II	National Park: protected area managed mainly for ecosystem protection and recreation	<p>Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible</p> <p><i>Category II areas should be managed for “ecosystem protection”, but should also provide for visitation, non- extractive recreational activities and nature tourism (e.g. snorkelling, diving, swimming, boating, etc.) and research (including managed extractive forms of research).</i></p>
III	Natural Monument: protected area managed mainly for conservation of specific natural features	<p>Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.</p> <p><i>Category III applies to MPAs designed to protect specific features such as: sea mounts or shipwrecks which have become aggregation sites for biodiversity and have important conservation value; key aggregation areas for iconic species; or other marine features which may have cultural or recreational value to particular groups, including flooded historical/archaeological landscapes.</i></p>

IV	Habitat/Species Management Area: protected area managed mainly for conservation through management intervention	Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species. <i>Category IV is aimed at protection of particular stated species or habitats, often with active management intervention (e.g., protection of key benthic habitats from trawling or dredging). MPAs or zones aimed at particular species or groups can be classified as category IV, e.g., seabird, turtle or shark sanctuaries. Zones within an MPA that have seasonal protection, such as turtle nesting beaches that are protected during the breeding season, might also qualify as category IV.</i>
V	Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area. <i>In a marine situation category V would apply to areas where local communities live within and sustainably use the seascape, but where the primary objectives of the areas are nevertheless nature conservation protection.</i>
VI	Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems	Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs. <i>MPAs aimed at maintaining predominantly natural habitats but allowing sustainable collection of some species (e.g. food species, ornamental coral or shells), can be assigned to category VI.</i>

IUCN PROTECTED CATEGORIES AND APPLICATION TO MPAS (IUCN, 2012 p9-10 & 19-23)

Resolution A.982(24)**Adopted on 1 December 2005 (Agenda item 11)****REVISED GUIDELINES FOR THE IDENTIFICATION AND DESIGNATION OF PARTICULARLY SENSITIVE SEA AREAS****1 INTRODUCTION**

1.1 The Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) began its study of the question of Particularly Sensitive Sea Areas (PSSAs) in response to a resolution of the International Conference on Tanker Safety and Pollution Prevention of 1978. The discussions of this concept from 1986 to 1991 culminated in the adoption of Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas by Assembly resolution A.720(17) in 1991. In a continuing effort to provide a clearer understanding of the concepts set forth in the Guidelines, the Assembly adopted resolutions A.885(21) and A.927(22). This document is intended to clarify and, where appropriate, strengthen certain aspects and procedures for the identification and designation of PSSAs and the adoption of associated protective measures (1). It sets forth revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas (the Guidelines or PSSA Guidelines).

1.2 A PSSA is an area that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities. At the time of designation of a PSSA, an associated protective measure¹, which meets the requirements of the appropriate legal instrument establishing such measure, must have been approved or adopted by IMO to prevent, reduce, or eliminate the threat or identified vulnerability. Information on each of the PSSAs that has been designated by IMO is available at www.imo.org.

1.3 Many international and regional instruments encourage the protection of areas important for the conservation of biological diversity as well as other areas with high ecological, cultural, historical/archaeological, socio-economic or scientific significance. These instruments further call upon their Parties to protect such vulnerable areas from damage or degradation, including from shipping activities.

1.4 The purpose of these Guidelines is to:

1. provide guidance to IMO Member Governments in the formulation and submission of applications for designation of PSSAs;

2. ensure that in the process all interests – those of the coastal State, flag State, and the environmental and shipping communities – are thoroughly considered on the basis of relevant scientific, technical, economic, and environmental information regarding the area at risk of damage from international shipping activities and the associated protective measures to prevent, reduce, or eliminate that risk; and

3. provide for the assessment of such applications by IMO.

1.5 Identification and designation of any PSSA and the adoption of associated protective measures require consideration of three integral components: the particular attributes of the proposed area, the vulnerability of such an area to damage by international shipping activities, and the availability of associated protective measures within the competence of IMO to prevent, reduce, or eliminate risks from these shipping activities.

¹ The term “associated protective measure” or “measure” is used both in the singular and plural throughout these Guidelines. It is important to recognize that an identified vulnerability may be addressed by only one or by more than one associated protective measure and that therefore the use of this terminology in the singular or plural should not be taken as any indication to the contrary.

2 INTERNATIONAL SHIPPING ACTIVITIES AND THE MARINE ENVIRONMENT

2.1 Shipping activity can constitute an environmental hazard to the marine environment in general and consequently even more so to environmentally and/or ecologically sensitive areas. Environmental hazards associated with shipping include:

1. operational discharges;
2. accidental or intentional pollution; and
3. physical damage to marine habitats or organisms.

2.2 Adverse effects and damage may occur to the marine environment and the living resources of the sea as a result of shipping activities. With the increase in global trade, shipping activities are also increasing, thus including greater potential for adverse effects and damage. In the course of routine operations, accidents, and wilful acts of pollution, ships may release a wide variety of substances either directly into the marine environment or indirectly through the atmosphere. Such releases include oil and oily mixtures, noxious liquid substances, sewage, garbage, noxious solid substances, anti-fouling systems, harmful aquatic organisms and pathogens, and even noise. In addition, ships may cause harm to marine organisms and their habitats through physical impact. These impacts may include the smothering of habitats, contamination by anti-fouling systems or other substances through groundings, and ship strikes of marine mammals.

3 PROCESS FOR THE DESIGNATION OF PARTICULARLY SENSITIVE SEA AREAS

3.1 The IMO is the only international body responsible for designating areas as Particularly Sensitive Sea Areas and adopting associated protective measures. An application to IMO for designation of a PSSA and the adoption of associated protective measures, or an amendment thereto, may be submitted only by a Member Government. Where two or more Governments have a common interest in a particular area, they should formulate a co-ordinated proposal ⁽²⁾. The proposal should contain integrated measures and procedures for co-operation between the jurisdictions of the proposing Member Governments.

3.2 Member Governments wishing to have IMO designate a PSSA should submit an application to MEPC based on the criteria outlined in section 4, provide information pertaining to the vulnerability of this area to damage from international shipping activities as called for in section 5, and include the proposed associated protective measures as outlined in section 6 to prevent, reduce or eliminate the identified vulnerability. Applications should be submitted in accordance with the procedures set forth in section 7 and the rules adopted by IMO for submission of documents.

3.3 If, in preparing its submission for a PSSA proposal, a Member Government requires technical assistance, that Government is encouraged to request such assistance from IMO.

² It is clear that the Guidelines recognize that an application for designation of a PSSA may be submitted by one or more Governments. For ease of drafting, however, the use of the word "Government" will be used throughout the text and it should be recognized that this term applies equally to applications where there is more than one Government involved.

4 ECOLOGICAL, SOCIO-ECONOMIC, OR SCIENTIFIC CRITERIA FOR THE IDENTIFICATION OF A PARTICULARLY SENSITIVE SEA AREA

4.1 The following criteria apply to the identification of PSSAs only with respect to the adoption of measures to protect such areas against damage, or the identified threat of damage, from international shipping activities.

4.2 These criteria do not, therefore, apply to the identification of such areas for the purpose of establishing whether they should be protected from dumping activities, since that is implicitly covered by the London Convention 1972 (the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972) and the 1996 Protocol to that Convention.

4.3 The criteria relate to PSSAs within and beyond the limits of the territorial sea. They can be used by IMO to designate PSSAs beyond the territorial sea with a view to the adoption of international protective measures regarding pollution and other damage caused by ships. They may also be used by national administrations to identify areas within their territorial seas that may have certain attributes reflected in the criteria and be vulnerable to damage by shipping activities.

4.4 In order to be identified as a PSSA, the area should meet at least one of the criteria listed below and information and supporting documentation should be provided to establish that at least one of the criteria exists throughout the entire proposed area, though the same criterion need not be present throughout the entire area. These criteria can be divided into three categories:

Ecological criteria; social, cultural, and economic criteria; and scientific and educational criteria.

Ecological criteria

4.4.1 Uniqueness or rarity – An area or ecosystem is unique if it is “the only one of its kind”.

Habitats of rare, threatened, or endangered species that occur only in one area are an example. An area or ecosystem is rare if it only occurs in a few locations or has been seriously depleted across its range. An ecosystem may extend beyond country borders, assuming regional or international significance. Nurseries or certain feeding, breeding, or spawning areas may also be rare or unique.

4.4.2 Critical habitat – A sea area that may be essential for the survival, function, or recovery of fish stocks or rare or endangered marine species, or for the support of large marine ecosystems.

4.4.3 Dependency – An area where ecological processes are highly dependent on biotically structured systems (e.g. coral reefs, kelp forests, mangrove forests, seagrass beds). Such ecosystems often have high diversity, which is dependent on the structuring organisms. Dependency also embraces the migratory routes of fish, reptiles, birds, mammals, and invertebrates.

4.4.4 Representativeness – An area that is an outstanding and illustrative example of specific biodiversity, ecosystems, ecological or physiographic processes, or community or habitat types or other natural characteristics.

4.4.5 Diversity – An area that may have an exceptional variety of species or genetic diversity or includes highly varied ecosystems, habitats, and communities.

4.4.6 Productivity – An area that has a particularly high rate of natural biological production. Such productivity is the net result of biological and physical processes which result in an increase in biomass in areas such as oceanic fronts, upwelling areas and some gyres.

4.4.7 Spawning or breeding grounds – An area that may be a critical spawning or breeding ground or nursery area for marine species which may spend the rest of their life-cycle elsewhere, or is recognized as migratory routes for fish, reptiles, birds, mammals, or invertebrates.

4.4.8 Naturalness – An area that has experienced a relative lack of human-induced disturbance or degradation.

4.4.9 Integrity – An area that is a biologically functional unit, an effective, self-sustaining ecological entity.

4.4.10 Fragility – An area that is highly susceptible to degradation by natural events or by the activities of people. Biotic communities associated with coastal habitats may have a low tolerance to changes in environmental conditions, or they may exist close to the limits of their tolerance (e.g., water temperature, salinity, turbidity or depth). Such communities may suffer natural stresses such as storms or other natural conditions (e.g., circulation patterns) that concentrate harmful substances in water or sediments, low flushing rates, and/or oxygen depletion. Additional stress may be caused by human influences such as pollution and changes in salinity. Thus, an area already subject to stress from natural and/or human factors may be in need of special protection from further stress, including that arising from international shipping activities.

4.4.11 Bio-geographic importance – An area that either contains rare biogeographic qualities or is representative of a biogeographic “type” or types, or contains unique or unusual biological, chemical, physical, or geological features.

Social, cultural and economic criteria

4.4.12 Social or economic dependency – An area where the environmental quality and the use of living marine resources are of particular social or economic importance, including fishing, recreation, tourism, and the livelihoods of people who depend on access to the area.

4.4.13 Human dependency – An area that is of particular importance for the support of traditional subsistence or food production activities or for the protection of the cultural resources of the local human populations.

4.4.14 Cultural heritage – An area that is of particular importance because of the presence of significant historical and archaeological sites.

Scientific and educational criteria

4.4.15 Research – An area that has high scientific interest.

4.4.16 Baseline for monitoring studies – An area that provides suitable baseline conditions with regard to biota or environmental characteristics, because it has not had substantial perturbations or has been in such a state for a long period of time such that it is considered to be in a natural or near-natural condition.

4.4.17 Education – An area that offers an exceptional opportunity to demonstrate particular natural phenomena.

4.5 In some cases a PSSA may be identified within a Special Area and vice versa. It should be noted that the criteria with respect to the identification of PSSAs and the criteria for the designation of Special Areas are not mutually exclusive.

5 VULNERABILITY TO IMPACTS FROM INTERNATIONAL SHIPPING

5.1 In addition to meeting at least one of the criteria listed in 4.4, the recognized attributes of the area should be at risk from international shipping activities. This involves consideration of the following factors:

Vessel traffic characteristics

5.1.1 Operational factors – Types of maritime activities (e.g. small fishing boats, small pleasure craft, oil and gas rigs) in the proposed area that by their presence may reduce the safety of navigation.

5.1.2 Vessel types – Types of vessels passing through or adjacent to the area (e.g. high-speed vessels, large tankers, or bulk carriers with small under-keel clearance).

5.1.3 Traffic characteristics – Volume or concentration of traffic, vessel interaction, distance offshore or other dangers to navigation, are such as to involve greater risk of collision or grounding.

5.1.4 Harmful substances carried – Type and quantity of substances on board, whether cargo, fuel or stores, that would be harmful if released into the sea.

Natural factors

5.1.5 Hydrographical – Water depth, bottom and coastline topography, lack of proximate safe anchorages and other factors which call for increased navigational caution.

5.1.6 Meteorological – Prevailing weather, wind strength and direction, atmospheric visibility and other factors which increase the risk of collision and grounding and also the risk of damage to the sea area from discharges.

5.1.7 Oceanographic – Tidal streams, ocean currents, ice, and other factors which increase the risk of collision and grounding and also the risk of damage to the sea area from discharges.

5.2 In proposing an area as a PSSA and in considering the associated protective measures to prevent, reduce, or eliminate the identified vulnerability, other information that might be helpful includes the following:

1. any evidence that international shipping activities are causing or may cause damage to the attributes of the proposed area, including the significance or risk of the potential damage, the degree of harm that may be expected to cause damage, and whether such damage is reasonably foreseeable, as well as whether damage is of a recurring or cumulative nature;
2. any history of groundings, collisions, or spills in the area and any consequences of such incidents;
3. any adverse impacts to the environment outside the proposed PSSA expected to be caused by changes to international shipping activities as a result of PSSA designation;
4. stresses from other environmental sources; and
5. any measures already in effect and their actual or anticipated beneficial impact.

6 ASSOCIATED PROTECTIVE MEASURES

6.1 In the context of these Guidelines, associated protective measures for PSSAs are limited to actions that are to be, or have been, approved or adopted by IMO and include the following options:

6.1.1 designation of an area as a Special Area under MARPOL Annexes I, II or V, or a SO_x emission control area under MARPOL Annex VI, or application of special discharge restrictions to vessels operating in a PSSA. Procedures and criteria for the designation of Special Areas are contained in the Guidelines for the Designation of Special Areas set forth in annex 1 of Assembly resolution A.927(22). Criteria and procedures for the designation of SO_x emission control areas are found in Appendix 3 to MARPOL Annex VI;

6.1.2 adoption of ships' routing and reporting systems near or in the area, under the International Convention for the Safety of Life at Sea (SOLAS) and in accordance with the General Provisions on Ships' Routing and the Guidelines and Criteria for Ship Reporting Systems. For example, a PSSA may be designated as an area to be avoided or it may be protected by other ships' routing or reporting systems; and

6.1.3 development and adoption of other measures aimed at protecting specific sea areas against environmental damage from ships, provided that they have an identified legal basis.

6.2 Consideration should also be given to the potential for the area to be listed on the World Heritage List, declared a Biosphere Reserve, or included on a list of areas of international, regional, or national importance, or if the area is already the subject of such international, regional, or national conservation action or agreements.

6.3 In some circumstances, a proposed PSSA may include within its boundaries a buffer zone, in other words, an area contiguous to the site-specific feature (core area) for which specific protection from shipping is sought. However, the need for such a buffer zone should be justified in terms of how it would directly contribute to the adequate protection of the core area.

7 PROCEDURE FOR THE DESIGNATION OF PARTICULARLY SENSITIVE SEA AREAS AND THE ADOPTION OF ASSOCIATED PROTECTIVE MEASURES

7.1 An application for PSSA designation should contain a proposal for an associated protective measure that the proposing Member Government intends to submit to the appropriate IMO body. If the measure is not already available under an IMO instrument, the proposal should set forth the steps that the proposing Member Government has taken or will take to have the measure approved or adopted by IMO pursuant to an identified legal basis (see paragraph 7.5.2.3).

7.2 Alternatively, if no new associated protective measure is being proposed because IMO measures are already associated with the area to protect it, then the application should identify the threat of damage or damage being caused to the area by international shipping activities and show how the area is already being protected from such identified vulnerability by the associated protective measures. Amendments to existing measures may be introduced to address identified vulnerabilities.

7.3 In the future, additional associated protective measures may also be introduced to address identified vulnerabilities.

7.4 The application should first clearly set forth a summary of the objectives of the proposed PSSA designation, the location of the area, the need for protection, the associated protective measures, and demonstrate how the identified vulnerability will be addressed by existing or proposed associated protective measures. The summary should

include the reasons why the associated protective measures are the preferred method for providing protection for the area to be identified as a PSSA.

7.5 Each application should then consist of two parts.

7.5.1 Part I – *Description, significance of the area and vulnerability*

1. *Description* – a detailed description of the location of the proposed area, along with a nautical chart on which the location of the area and any associated protective measures are clearly marked, should be submitted with the application.
2. *Significance of the area* – the application should state the significance of the area on the basis of recognized ecological, socio-economic, or scientific attributes and should explicitly refer to the criteria listed above in section 4.
3. *Vulnerability of the area to damage by international shipping activities* – the application should provide an explanation of the nature and extent of the risks that international shipping activities pose to the environment of the proposed area, noting the factors listed in section 5. The application should describe the
4. particular current or future international shipping activities that are causing or may be expected to cause damage to the proposed area, including the significance of the damage and degree of harm that may result from such activities, either from such activity alone or in combination with other threats.

7.5.2 Part II – *Appropriate associated protective measures and IMO's competence to approve or adopt such measures*

1. The application should identify the existing and/or proposed associated protective measures and describe how they provide the needed protection from the threats of damage posed by international maritime activities occurring in and around the area. The application should specifically describe how the associated protective measures protect the area from the identified vulnerability.
2. If the application identifies a new associated protective measure, then the proposing Member Government must append a draft of the proposal which is intended to be submitted to the appropriate Sub-Committee or Committee or, if the measures are not already available in an IMO instrument, information must be provided with regard to its legal basis and/or the steps that the proposing Member Government has taken or will take to establish the legal basis.
3. The application should identify the legal basis for each measure. The legal bases for such measures are:

- (i) any measure that is already available under an existing IMO instrument; or
- (ii) any measure that does not yet exist but could become available through amendment of an IMO instrument or adoption of a new IMO instrument.

The legal basis for any such measure would only be available after the IMO instrument was amended or adopted, as appropriate; or

- (iii) any measure proposed for adoption in the territorial sea*, or pursuant to Article 211(6) of the United Nations Convention on the Law of the Sea where existing measures or a generally applicable measure (as set forth in subparagraph (ii) above) would not adequately address the particularized need of the proposed area.

**This provision does not derogate from the rights and duties of coastal States in the territorial sea as provided for in the United Nations Convention on the Law of the Sea.*

4. These measures may include ships' routing measures; reporting requirements discharge restrictions; operational criteria; and prohibited activities, and should be specifically tailored to meet the need of the area to prevent, reduce, or eliminate the identified vulnerability of the area from international shipping activities.

5. The application should clearly specify the category or categories of ships to which the proposed associated protective measures would apply, consistent with the provisions of the United Nations Convention on the Law of the Sea, including those related to vessels entitled to sovereign immunity, and other pertinent instruments.

7.6 The application should indicate the possible impact of any proposed measures on the safety and efficiency of navigation, taking into account the area of the ocean in which the proposed measures are to be implemented. The application should set forth such information as:

- 1. consistency with the legal instrument under which the associated protective measure is being proposed;
- 2. implications for vessel safety; and
- 3. impact on vessel operations, such as existing traffic patterns or usage of the proposed area.

7.7 An application for PSSA designation should address all relevant considerations and criteria in these Guidelines, and should include relevant supporting information for each such item.

7.8 The application should contain a summary of steps taken, if any, by the proposing Member Government to date to protect the proposed area.

7.9 The proposing Member Government should also include in the application the details of action to be taken pursuant to domestic law for the failure of a ship to comply with the requirements of the associated protective measures. Any action taken should be consistent with international law as reflected in the United Nations Convention on the Law of the Sea.

7.10 The proposing Member Government should submit a separate proposal to the appropriate Sub-Committee or Committee to obtain the approval of any new associated protective measure. Such a proposal must comply with the requirements of the legal instrument relied upon to establish the measure.

8 CRITERIA FOR ASSESSMENT OF APPLICATIONS FOR DESIGNATION OF PARTICULARLY SENSITIVE SEA AREAS AND THE ADOPTION OF ASSOCIATED PROTECTIVE MEASURES

8.1 IMO should consider each application, or amendment thereto, submitted to it by a proposing Member Government on a case-by-case basis to determine whether the area fulfils at least one of the criteria set forth in section 4, the attributes of the area meeting section 4 criteria are vulnerable to damage by international shipping activities as set forth in section 5, and associated protective measures exist or are proposed to prevent, reduce, or eliminate the identified vulnerability.

8.2 In assessing each proposal, IMO should in particular consider:

1. the full range of protective measures available and determine whether the proposed or existing associated protective measures are appropriate to prevent, reduce, or eliminate the identified vulnerability of the area from international shipping activities;
2. whether such measures might result in an increased potential for significant adverse effects by international shipping activities on the environment outside the proposed PSSA; and
3. the linkage between the recognized attributes, the identified vulnerability, the associated protective measure to prevent, reduce, or eliminate that vulnerability, and the overall size of the area, including whether the size is commensurate with that necessary to address the identified need.

8.3 The procedure for considering a PSSA application by IMO is as follows:

1. the MEPC should bear primary responsibility within IMO for considering PSSA

applications and all applications should first be submitted to the MEPC:

1. the Committee should assess the elements of the proposal against the Guidelines and, as appropriate, should establish a technical group, comprising representatives with appropriate environmental, scientific, maritime, and legal expertise;
 2. the proposing Member Government is encouraged to make a presentation of the proposal, along with nautical charts and other supporting information on the required elements for PSSA designation;
 3. any technical group formed should prepare a brief report to the Committee summarizing their findings and the outcome of its assessment; and
 4. the outcome of the assessment of a PSSA application should be duly reflected in the report of the MEPC;
2. if appropriate following its assessment, the MEPC should designate the area “in principle” and inform the appropriate Sub-Committee, Committee (which could be the MEPC itself), or the Assembly that is responsible for addressing the particular associated protective measures proposed for the area of the outcome of this assessment;
3. the appropriate Sub-Committee or Committee which has received a submission by a proposing Member Government for an associated protective measure should review the proposal to determine whether it meets the procedures, criteria, and other requirements of the legal instrument under which the measure is proposed. The Sub-Committee may seek the advice of the MEPC on issues pertinent to the application;
4. the MEPC should not designate a PSSA until after the associated protective measures are considered and approved by the pertinent Sub-Committee, Committee, or Assembly. If the associated protective measures are not approved by the pertinent IMO body, then the MEPC may reject the PSSA application entirely or request that the proposing Member Government submit new proposals for associated protective measures. A proper record of the proceedings should be included in the report of the MEPC;
- 5, for measures that require approval by the Maritime Safety Committee (MSC), the Sub-Committee should forward its recommendation for approval of the associated protective measures to the MSC or, if the Sub-Committee rejects the measures, it should inform the MSC and MEPC and provide a statement of reasons for its decision. The MSC should consider any such recommendations and, if the measures are to be adopted, it should notify the MEPC of its decision;

6. if the application is rejected, the MEPC shall notify the proposing Member Government, provide a statement of reasons for its decision and, if appropriate, request the Member Government to submit additional information; and

7. after approval by the appropriate Sub-Committee, Committee, or, where necessary, the Assembly of the associated protective measures, the MEPC may designate the area as a PSSA.

8.4 IMO should provide a forum for the review and re-evaluation of any associated protective measure adopted, as necessary, taking into account pertinent comments, reports, and observations of the associated protective measures. Member Governments which have ships operating in the area of the designated PSSA are encouraged to bring any concerns with the associated protective measures to IMO so that any necessary adjustments may be made. Member Governments that originally submitted the application for designation with the associated protective measures, should also bring any concerns and proposals for additional measures or modifications to any associated protective measure or the PSSA itself to IMO.

8.5 After the designation of a PSSA and its associated protective measures, IMO should ensure that the effective date of implementation is as soon as possible based on the rules of IMO and consistent with international law.

8.6 IMO should, in assessing applications for designation of PSSAs and their associated protective measures, take into account the technical and financial resources available to developing Member Governments and those with economies in transition.

9 IMPLEMENTATION OF DESIGNATED PSSAs AND THE ASSOCIATED PROTECTIVE MEASURES

9.1 When a PSSA receives final designation, all associated protective measures should be identified on charts in accordance with the symbols and methods of the International Hydrographic Organization (IHO).

9.2 A proposing Member Government should ensure that any associated protective measure is implemented in accordance with international law as reflected in the United Nations Convention on the Law of the Sea.

9.3 Member Governments should take all appropriate steps to ensure that ships flying their flag comply with the associated protective measures adopted to protect the designated PSSA. Those Member Governments which have received information of an alleged violation of an associated protective measure by a ship flying their flag should

provide the Government which has reported the offence with the details of any appropriate action taken.